

## PROTEINS AND NUCLEIC ACIDS ENCODING SAME

### RELATED APPLICATIONS

This application claims priority from Provisional Applications U.S.S.N. 60/258,928, filed December 29, 2000, U.S.S.N. 60/259,415, filed January 2, 2001, U.S.S.N. 60/259,785, filed January 4, 2001, U.S.S.N. 60/269,814, filed February 20, 2001, U.S.S.N. 60/279,832, filed March 29, 2001, U.S.S.N. 60/279,833, filed March 29, 2001, U.S.S.N. 60/279,863, filed March 29, 2001, U.S.S.N. 60/283,889, filed April 13, 2001, U.S.S.N. 60/284,447, filed April 18, 2001, U.S.S.N. 60/286,683, filed April 25, 2001, U.S.S.N. 60/294,080, filed May 29, 2001, U.S.S.N. 60/312,915, filed August 16, 2001, U.S.S.N. 60/313,325, filed August 17, 2001, U.S.S.N. 60/322,699, filed September 17, 2001, U.S.S.N. not yet assigned (bearing attorney docket number 21402-234E4), filed November 26, 2001, each of which is incorporated by reference in its entirety.

### FIELD OF THE INVENTION

The invention relates to polynucleotides and the polypeptides encoded by such polynucleotides, as well as vectors, host cells, antibodies and recombinant methods for producing the polypeptides and polynucleotides, as well as methods for using the same.

### BACKGROUND OF THE INVENTION

The invention generally relates to nucleic acids and polypeptides encoded therefrom. More specifically, the invention relates to nucleic acids encoding cytoplasmic, nuclear, membrane bound, and secreted polypeptides, as well as vectors, host cells, antibodies, and recombinant methods for producing these nucleic acids and polypeptides.

### SUMMARY OF THE INVENTION

The invention is based in part upon the discovery of nucleic acid sequences encoding novel polypeptides. The novel nucleic acids and polypeptides are referred to herein as NOVX, or NOV1, NOV2, NOV3, NOV4, NOV5, NOV6, NOV7, NOV8, NOV9, NOV10, NOV11, NOV12, NOV13, NOV14, NOV15, NOV16, NOV17, NOV18, NOV19, and NOV20 nucleic

acids and polypeptides. These nucleic acids and polypeptides, as well as variants, derivatives, homologs, analogs and fragments thereof, will hereinafter be collectively designated as "NOVX" nucleic acid or polypeptide sequences.

In one aspect, the invention provides an isolated NOVX nucleic acid molecule  
5 encoding a NOVX polypeptide that includes a nucleic acid sequence that has identity to the nucleic acids disclosed in SEQ ID NOS:1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59. In some embodiments, the NOVX nucleic acid molecule will hybridize under stringent conditions to a nucleic acid sequence complementary to a nucleic acid molecule that includes a protein-coding sequence of a NOVX  
10 nucleic acid sequence. The invention also includes an isolated nucleic acid that encodes a NOVX polypeptide, or a fragment, homolog, analog or derivative thereof. For example, the nucleic acid can encode a polypeptide at least 80% identical to a polypeptide comprising the amino acid sequences of SEQ ID NOS:2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, and 60. The nucleic acid can be, for example,  
15 a genomic DNA fragment or a cDNA molecule that includes the nucleic acid sequence of any of SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59.

Also included in the invention is an oligonucleotide, *e.g.*, an oligonucleotide which includes at least 6 contiguous nucleotides of a NOVX nucleic acid (*e.g.*, SEQ ID NOS: 1, 3, 5,  
20 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59) or a complement of said oligonucleotide.

Also included in the invention are substantially purified NOVX polypeptides (SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, and 60). In certain embodiments, the NOVX polypeptides include an amino  
25 acid sequence that is substantially identical to the amino acid sequence of a human NOVX polypeptide.

The invention also features antibodies that immunoselectively bind to NOVX polypeptides, or fragments, homologs, analogs or derivatives thereof.

In another aspect, the invention includes pharmaceutical compositions that include  
30 therapeutically- or prophylactically-effective amounts of a therapeutic and a pharmaceutically-acceptable carrier. The therapeutic can be, *e.g.*, a NOVX nucleic acid, a NOVX polypeptide, or an antibody specific for a NOVX polypeptide. In a further aspect, the invention includes, in one or more containers, a therapeutically- or prophylactically-effective amount of this pharmaceutical composition.

In a further aspect, the invention includes a method of producing a polypeptide by culturing a cell that includes a NOVX nucleic acid, under conditions allowing for expression of the NOVX polypeptide encoded by the DNA. If desired, the NOVX polypeptide can then be recovered.

5 In another aspect, the invention includes a method of detecting the presence of a NOVX polypeptide in a sample. In the method, a sample is contacted with a compound that selectively binds to the polypeptide under conditions allowing for formation of a complex between the polypeptide and the compound. The complex is detected, if present, thereby identifying the NOVX polypeptide within the sample.

10 The invention also includes methods to identify specific cell or tissue types based on their expression of a NOVX.

Also included in the invention is a method of detecting the presence of a NOVX nucleic acid molecule in a sample by contacting the sample with a NOVX nucleic acid probe or primer, and detecting whether the nucleic acid probe or primer bound to a NOVX nucleic acid molecule in the sample.

15 In a further aspect, the invention provides a method for modulating the activity of a NOVX polypeptide by contacting a cell sample that includes the NOVX polypeptide with a compound that binds to the NOVX polypeptide in an amount sufficient to modulate the activity of said polypeptide. The compound can be, *e.g.*, a small molecule, such as a nucleic acid, peptide, polypeptide, peptidomimetic, carbohydrate, lipid or other organic (carbon containing) or inorganic molecule, as further described herein.

20 Also within the scope of the invention is the use of a therapeutic in the manufacture of a medicament for treating or preventing disorders or syndromes including, *e.g.*, those described for the individual NOVX nucleotides and polypeptides herein, and/or other pathologies and disorders of the like.

25 The therapeutic can be, *e.g.*, a NOVX nucleic acid, a NOVX polypeptide, or a NOVX-specific antibody, or biologically-active derivatives or fragments thereof. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from the diseases and disorders disclosed below and/or other pathologies and disorders of the like. The polypeptides can be used as immunogens to produce antibodies specific for the invention, and as vaccines. They can also be used to screen for potential agonist and antagonist compounds. For example, a cDNA encoding NOVX may be useful in gene therapy, and NOVX may be useful when administered to a subject in need thereof. By way of non-limiting example, the compositions of the present invention will have efficacy for

treatment of patients suffering from the diseases and disorders disclosed above and/or other pathologies and disorders of the like.

The invention further includes a method for screening for a modulator of disorders or syndromes including, *e.g.*, the diseases and disorders disclosed above and/or other pathologies and disorders of the like. The method includes contacting a test compound with a NOVX polypeptide and determining if the test compound binds to said NOVX polypeptide. Binding of the test compound to the NOVX polypeptide indicates the test compound is a modulator of activity, or of latency or predisposition to the aforementioned disorders or syndromes.

Also within the scope of the invention is a method for screening for a modulator of activity, or of latency or predisposition to an disorders or syndromes including, *e.g.*, the diseases and disorders disclosed above and/or other pathologies and disorders of the like by administering a test compound to a test animal at increased risk for the aforementioned disorders or syndromes. The test animal expresses a recombinant polypeptide encoded by a NOVX nucleic acid. Expression or activity of NOVX polypeptide is then measured in the test animal, as is expression or activity of the protein in a control animal which recombinantly-expresses NOVX polypeptide and is not at increased risk for the disorder or syndrome. Next, the expression of NOVX polypeptide in both the test animal and the control animal is compared. A change in the activity of NOVX polypeptide in the test animal relative to the control animal indicates the test compound is a modulator of latency of the disorder or syndrome.

In yet another aspect, the invention includes a method for determining the presence of or predisposition to a disease associated with altered levels of a NOVX polypeptide, a NOVX nucleic acid, or both, in a subject (*e.g.*, a human subject). The method includes measuring the amount of the NOVX polypeptide in a test sample from the subject and comparing the amount of the polypeptide in the test sample to the amount of the NOVX polypeptide present in a control sample. An alteration in the level of the NOVX polypeptide in the test sample as compared to the control sample indicates the presence of or predisposition to a disease in the subject. Preferably, the predisposition includes, *e.g.*, the diseases and disorders disclosed above and/or other pathologies and disorders of the like. Also, the expression levels of the new polypeptides of the invention can be used in a method to screen for various cancers as well as to determine the stage of cancers.

In a further aspect, the invention includes a method of treating or preventing a pathological condition associated with a disorder in a mammal by administering to the subject a NOVX polypeptide, a NOVX nucleic acid, or a NOVX-specific antibody to a subject (*e.g.*, a



human subject), in an amount sufficient to alleviate or prevent the pathological condition. In preferred embodiments, the disorder, includes, *e.g.*, the diseases and disorders disclosed above and/or other pathologies and disorders of the like.

In yet another aspect, the invention can be used in a method to identify the cellular receptors and downstream effectors of the invention by any one of a number of techniques commonly employed in the art. These include but are not limited to the two-hybrid system, affinity purification, co-precipitation with antibodies or other specific-interacting molecules. Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs.

Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present invention, suitable methods and materials are described below. All publications, patent applications, patents, and other references mentioned herein are incorporated by reference in their entirety. In the case of conflict, the present specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and not intended to be limiting.

Other features and advantages of the invention will be apparent from the following detailed description and claims.

## DETAILED DESCRIPTION OF THE INVENTION

The present invention provides novel nucleotides and polypeptides encoded thereby. Included in the invention are the novel nucleic acid sequences and their polypeptides. The sequences are collectively referred to as "NOVX nucleic acids" or "NOVX polynucleotides" and the corresponding encoded polypeptides are referred to as "NOVX polypeptides" or "NOVX proteins." Unless indicated otherwise, "NOVX" is meant to refer to any of the novel sequences disclosed herein. Table A provides a summary of the NOVX nucleic acids and their encoded polypeptides.

**TABLE A. Sequences and Corresponding SEQ ID Numbers**

NOVX	Internal Identification	SEQ ID NO (nt)	SEQ ID NO (aa)	Homology
1	Sggc_draft_ba186014_20000730_da1	1	2	Lysosomal Acid Lipase Precursor
2	20708613_EXT1	3	4	MEGF/Flamingo/Cadherin
3	CG55806_01	5	6	Coagulation Factor IX Precursor
4	CG55936_01	7	8	Carbonic Anhydrase IV
5	CG55784_01	9	10	Neural Cell Adhesion Molecule
6	CG55916_01	11	12	Phospholipase C Delta
7	CG55802_01	13	14	3 Alpha Hydroxy Steroid Dehydrogenase
8	CG55904_01	15	16	Squalene Desaturase
9	CG55954_01	17	18	Lymphocyte Antigen 64

10	CG55910_01	19	20	Acyl-CoA Desaturase
11	CG50281_01	21	22	Wnt 10B Protein Precursor
12a	CG55920_01	23	24	Kilon Protein Precursor
12b	CG55920_04	25	26	Kilon Protein Precursor
13a	CG55988_01	27	28	Organic Cation Transporter
13b	CG55988_02	29	30	Organic Cation Transporter
14a	CG56001_01	31	32	D-beta Hydroxy Hydroxybutyrate Dehydrogenase
14b	CG56001_02	33	34	D-beta Hydroxy Hydroxybutyrate Dehydrogenase
15a	SC145665404_A/CG55069_01	35	36	TEN-M3
15b	CG55069_02	37	38	TEN-M3
15c	CG55069_03	39	40	TEN-M3
15d	CG55069_08	41	42	TEN-M3
16a	CG55778_01	43	44	Aldose Reductase
16b	CG55778_02	45	46	Aldose Reductase
16c	CG55778_03	47	48	Aldose Reductase
16d	CG55778_04	49	50	Aldose Reductase
16e	CG55778_05	51	52	Aldose Reductase
17	CG55982_01	53	54	Apolipoprotein A-1
18	CG56747_02	55	56	Apolipoprotein A-1
19	CG55906_01	57	58	S3_12
20	CG55906_02	59	60	S3_12

NOVX nucleic acids and their encoded polypeptides are useful in a variety of applications and contexts. The various NOVX nucleic acids and polypeptides according to the invention are useful as novel members of the protein families according to the presence of domains and sequence relatedness to previously described proteins. Additionally, NOVX nucleic acids and polypeptides can also be used to identify proteins that are members of the family to which the NOVX polypeptides belong.

The NOVX genes and their corresponding encoded proteins are useful for preventing, treating or ameliorating medical conditions, *e.g.*, by protein or gene therapy. Pathological conditions can be diagnosed by determining the amount of the new protein in a sample or by determining the presence of mutations in the new genes. Specific uses are described for each of the sixteen genes, based on the tissues in which they are most highly expressed. Uses include developing products for the diagnosis or treatment of a variety of diseases and disorders.

The NOVX nucleic acids and polypeptides can also be used to screen for molecules, which inhibit or enhance NOVX activity or function. Specifically, the nucleic acids and polypeptides according to the invention may be used as targets for the identification of small molecules that modulate or inhibit, *e.g.*, neurogenesis, cell differentiation, cell proliferation, hematopoiesis, wound healing and angiogenesis.

In one embodiment of the present invention, NOVX or a fragment or derivative thereof may be administered to a subject to treat or prevent a disorder associated with decreased expression or activity of NOVX. Examples of such disorders include, but are not limited to,

cancers such as adenocarcinoma, leukemia, lymphoma, melanoma, myeloma, sarcoma, teratocarcinoma, and, in particular, cancers of the adrenal gland, bladder, bone, bone marrow, brain, breast, cervix, gall bladder, ganglia, gastrointestinal tract, heart, kidney, liver, lung, muscle, ovary, pancreas, parathyroid, penis, prostate, salivary glands, skin, spleen, testis, thymus, thyroid, and uterus; neurological disorders such as epilepsy, ischemic cerebrovascular disease, stroke, cerebral neoplasms, Alzheimer's disease, Pick's disease, Huntington's disease, dementia, Parkinson's disease and other extrapyramidal disorders, amyotrophic lateral sclerosis and other motor neuron disorders, progressive neural muscular atrophy, retinitis pigmentosa, hereditary ataxias, multiple sclerosis and other demyelinating diseases, bacterial and viral meningitis, brain abscess, subdural empyema, epidural abscess, suppurative intracranial thrombophlebitis, myelitis and radiculitis, viral central nervous system disease, prion diseases including kuru, Creutzfeldt-Jakob disease, and Gerstmann-Straussler-Scheinker syndrome, fatal familial insomnia, nutritional and metabolic diseases of the nervous system, neurofibromatosis, tuberous sclerosis, cerebelloretinal hemangioblastomatosis, encephalotrigeminal syndrome, mental retardation and other developmental disorders of the central nervous system, cerebral palsy, neuroskeletal disorders, autonomic nervous system disorders, cranial nerve disorders, spinal cord diseases, muscular dystrophy and other neuromuscular disorders, peripheral nervous system disorders, dermatomyositis and polymyositis, inherited, metabolic, endocrine, and toxic myopathies, myasthenia gravis, periodic paralysis, mental disorders including mood, anxiety, and schizophrenic disorders, akathisia, amnesia, catatonia, diabetic neuropathy, tardive dyskinesia, dystonias, paranoid psychoses, postherpetic neuralgia, and Tourette's disorder; and disorders of vesicular transport such as cystic fibrosis, glucose-galactose malabsorption syndrome, hypercholesterolemia, diabetes mellitus, diabetes insipidus, hyper- and hypoglycemia, Grave's disease, goiter, Cushing's disease, Addison's disease, gastrointestinal disorders including ulcerative colitis, gastric and duodenal ulcers, other conditions associated with abnormal vesicle trafficking including acquired immunodeficiency syndrome (AIDS), allergic reactions, autoimmune hemolytic anemia, proliferative glomerulonephritis, inflammatory bowel disease, multiple sclerosis, myasthenia gravis, rheumatoid arthritis, osteoarthritis, scleroderma, Chediak-Higashi syndrome, Sjogren's syndrome, systemic lupus erythematosus, toxic shock syndrome, traumatic tissue damage, and viral, bacterial, fungal, helminthic, and protozoal infections, as well as additional indications listed for the individual NOVX clones.

The NOVX nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications and as a research tool. These include serving as a

specific or selective nucleic acid or protein diagnostic and/or prognostic marker, wherein the presence or amount of the nucleic acid or the protein are to be assessed. These also include potential therapeutic applications such as the following: (i) a protein therapeutic, (ii) a small molecule drug target, (iii) an antibody target (therapeutic, diagnostic, drug targeting/cytotoxic antibody), (iv) a nucleic acid useful in gene therapy (gene delivery/gene ablation), (v) an agent promoting tissue regeneration *in vitro* and *in vivo*, and (vi) a biological defense weapon. Additional utilities for the NOVX nucleic acids and polypeptides according to the invention are disclosed herein.

## NOV1

A disclosed NOV1 nucleic acid (SEQ ID NO:1) of 1138 nucleotides (also referred to as sggc\_draft\_ba186014\_20000730\_da1) encoding a novel LYSOSOMAL ACID LIPASE PRECURSOR-like protein is shown in Table 1A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 8-10 and ending with a TAA codon at nucleotides 1127-1129. Putative untranslated regions are found upstream from the initiation codon and downstream from the termination codon, and are underlined. The start and stop codons are shown in bold letters in Table 1A.

**Table 1A. NOV1 nucleotide sequence (SEQ ID NO:1).**

GTCCAAAATGTGGCTGCTTTTAACAACAACCTGTTTGATCTGTGGAACTTTAAATGCTGGTGGAT  
TCCTTGATTTGGAAAATGAAGTGAATCCTGAGGTGTGGATGAATACTAGTGAAATCATCATCTAC  
AATGGCTACCCCACTGAAGAGTATGAAGTCAACACTGAAGATGGGTATATACTCCTTGTCAACAG  
AATTCCTTATGGGCGAACACATGCTAGGAGCACAGGTCCCGGCCAGTTGTGTATATGCAGCATG  
CCCTGTTTGCAGACAATGCCTACTGGCTTGAGAATTATGCTAATGGAAGCCTTGGATTCCCTTCTA  
GCAGATGCAGGTTATGATGTATGGATGGGAAACAGTCGGGGAAACACTTGGTCAAGAAGACACAA  
AACACTCTCAGAGACAGATGAGAAATCTGGGCCTTTGGTTTTGATGAAATGGCCAAATATGATC  
TCCCAGGAGTAATAGACTTCATTGTAAATAAACTGGTCAGGAGAAATTGTATTTTCAATGGACAT  
TCACTTGGCACTACAATAGGGTTTGTAGCCTTTTCCACCATGCCTGAACCTGGCACAAAGAATCAA  
AATGAATTTTGCCTTGGGTCTACGATCTCATTCAAATATCCACGGGCATTTTACCAGGTTTTT  
TTCTACTTCCAAATCCATAATCAAGGCTGTTTTTGGTACCAAAGGTTTCTTTTGAAGATAAG  
AAAACGAAGATAGCTTCTACCAAAATCTGCAACAATAAGATACTCTGGTTGATATGTAGCGAATT  
TATGTCCTTATGGGCTGGATCCAACAAGAAAAATATGAATCAGCTTTACCACTCTGATGAATTCA  
GAGCTTATGACTGGGGAATGACGCTGATAATATGAAACATTACAATCAGAGTCATCCCCCTATA  
TATGACCTGACTGCCATGAAAGTGCCTACTGCTATTTGGGCTGGTGGACATGATGTCTCGTAAC  
ACCCAGGATGTGGCCAGGATACTCCCTCAAATCAAGAGTCTTCATTACTTTAAGCTATTGCCAG  
ATTGGAACCACTTTGATTTTGTCTGGGGCTCGATGCCCTCAACGGATGTACAGTGAAATCATA  
GCTTTAATGAAGGCATATTCTTAAATGCAATGC

The NOV1 sequence of the invention and all the NOVX sequences described herein were derived by laboratory cloning of cDNA fragments covering the full length and/or part of the DNA sequence of the invention, and/or by in silico prediction of the full length and/or part of the DNA sequence of the invention from public human sequence databases.

A disclosed NOV1 polypeptide (SEQ ID NO:2) encoded by SEQ ID NO:1 has 373 amino acid residues and is presented in Table 1B using the one-letter amino acid code. SignalP, Psort and/or Hydropathy results predict that NOV1 has a signal peptide and is likely to be localized to the plasma membrane. In an alternative embodiment, NOV1 is likely to be localized to the lysosome (lumen) with a certainty of 0.5500. The most likely cleavage site for a NOV1 peptide is between amino acids 17 and 18, *i.e.*, at the dash between amino acids LNA-GG. NOV1 has a molecular weight of 42681.4 Daltons.

**Table 1B. Encoded NOV1 protein sequence (SEQ ID NO:2).**

MWLLLLTTTCLICGTLNAGGFLDLENEVNPEVWMNTSEII IYNGYPSEYEVTEDGYILLVNR IPYGRTHARSTGPRPVVYMQHALFADNAYWLENYANGSLGFLADAGYDVWMCNSRGNTWSRR HKTLSSETDEKFWAFGFDEMAKYDLPGVIDFIVNKTGQEKLYFIGHSLGTTIGFVAFSTMPELA QRIKMNFAFGPTISFKYPTGIFTRFLLPNSIIKAVFGTKGFFLEDKKTIASTKICNNKILW LICSEFMSLWAGSNKKNMNQLYHSDEFRAWDGNDADNMKHYNQSHPPIDLTAMKVPTAIWA GGHDVLVTFQDVARILPQIKSLHYFKLLPDWNHFDVWGLDAPQRMYSIIALMKAYS
---

In all BLAST alignments herein, the “E-value” or “Expect” value is a numeric indication of the probability that the aligned sequences could have achieved their similarity to the BLAST query sequence by chance alone, within the database that was searched. The Expect value (E) is a parameter that describes the number of hits one can “expect” to see just by chance when searching a database of a particular size. It decreases exponentially with the Score (S) that is assigned to a match between two sequences. Essentially, the E value describes the random background noise that exists for matches between sequences.

The Expect value is used as a convenient way to create a significance threshold for reporting results. The default value used for blasting is typically set to 0.0001, with the filter to remove low complexity sequence turned off. In BLAST 2.0, the Expect value is also used instead of the P value (probability) to report the significance of matches. For example, an E value of one assigned to a hit can be interpreted as meaning that in a database of the current size one might expect to see one match with a similar score simply by chance. An E value of zero means that one would not expect to see any matches with a similar score simply by chance. See, *e.g.*, <http://www.ncbi.nlm.nih.gov/Education/BLASTinfo/>. Occasionally, a string of X’s or N’s will result from a BLAST search. This is a result of automatic filtering of the query for low-complexity sequence that is performed to prevent artifactual hits. The filter substitutes any low-complexity sequence that it finds with the letter “N” in nucleotide sequence (*e.g.*, “NNNNNNNN”) or the letter “X” in protein sequences (*e.g.*, “XXX”). Low-complexity regions can result in high scores that reflect compositional bias rather than significant position-by-position alignment. Wootton and Federhen, *Methods Enzymol* 266:554-571, (1996).

In a search of sequence databases, it was found, for example, that the amino acid sequence of this invention has 154 of 297 bases (51%) identical to a ptnr:SPTREMBL-ACC:Q16529 LYSOSOMAL ACID LIPASE PRECURSOR - Homo sapiens.

In a further search of public sequence databases, NOV1 was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 1C.

Table 1C. BLASTP results for NOV1					
Gene Index/ Identifier	Protein/ Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SPTREMBL- ACC:Q16529	LYSOSOMAL ACID LIPASE PRECURSOR - Homo sapiens	399	154/297 (51%)	202/297 (68%)	7.2e- 109
ptnr:pir-id:S41408	lysosomal acid lipase (EC 3.1.1.-) / sterol esterase (EC 3.1.1.13) precursor - human	399	154/297 (51%)	202/297 (68%)	1.2e- 108
ptnr:SWISSPROT- ACC:P38571	Lysosomal acid lipase/cholesteryl ester hydrolase precursor (EC 3.1.1.13) (LAL) (Acid cholesteryl ester hydrolase) (Sterol esterase) (Lipase A) (Cholesteryl esterase) - Homo sapiens	399	153/297 (51%)	201/297 (67%)	5.1e- 108
ptnr:SPTREMBL- ACC:Q96EJ0	SIMILAR TO LIPASE A, LYSOSOMAL ACID, CHOLESTEROL ESTERASE (WOLMAN DISEASE) - Homo sapiens	399	152/297 (51%)	201/297 (67%)	1.0e- 107
ptnr:SWISSPROT- ACC:P07098	Triacylglycerol lipase, gastric precursor (EC 3.1.1.3) (Gastric lipase) (GL) - Homo sapiens	398	146/297 (49%)	196/297 (65%)	5.8e- 105

The homology of these sequences is shown graphically in the ClustalW analysis shown in Table 1D. In the ClustalW alignment of the NOV1 protein, as well as all other ClustalW analyses herein, the black outlined amino acid residues indicate regions of conserved sequence (*i.e.*, regions that may be required to preserve structural or functional properties), whereas non-highlighted amino acid residues are less conserved and can potentially be mutated to a much broader extent without altering protein structure or function. NOV1 polypeptide is provided in lane 1.

Table 1D. ClustalW Analysis of NOV1	
1)	NOV1 (SEQ ID NO:2)
2)	Q16529 (SEQ ID NO:61)
3)	S41408 (SEQ ID NO:62)
4)	P38571 (SEQ ID NO:63)
5)	Q96EJ0 (SEQ ID NO:64)

6) P07098 (SEQ ID NO:65)

```

      10      20      30      40      50      60      70      80
NOV1  --FWLLTTTCLICGTLNAGGFLDLENEVNPPEVMMNISEITLYNCPSEEEYVETEDGYILLNRIIPGRTHARSTGPRF
Q16529 MKMRFLGLVVCVLVNLHSESGRGKLTAVDPETNMNVSEIIISYWGFPSEYLVETEDGYILCLNRIIPHGRKNHSDKGPKE
S41408 MKMRFLGLVVCVLVNLHSESGRGKLTAVDPETNMNVSEIIISYWGFPSEYLVETEDGYILCLNRIIPHGRKNHSDKGPKE
P38571 MKMRFLGLVVCVLVNLHSESGRGKLTAVDPETNMNVSEIIISYWGFPSEYLVETEDGYILCLNRIIPHGRKNHSDKGPKE
Q96EJ0 MKMRFLGLVVCVLVNLHSESGRGKLTAVDPETNMNVSEIIISYWGFPSEYLVETEDGYILCLNRIIPHGRKNHSDKGPKE
P07098 --FWLLTTTCLICGTLNAGGFLDLENEVNPPEVMMNISEITLYNCPSEEEYVETEDGYILLNRIIPGRTHARSTGPRF

      90     100     110     120     130     140     150     160
NOV1  VVMQCHAFADNAYNENYANGSLGFLADAGFDVVMGNSRGNTWSRKHKTLSEDEKFWAFGEDEMAKYDLPASINFIL
Q16529 VVFLQHGGLADSSNNVTNLANSLSGLFILADAGFDVVMGNSRGNTWSRKHKTLVSQDEFWAFSYDEMAKYDLPASINFIL
S41408 VVFLQHGGLADSSNNVTNLANSLSGLFILADAGFDVVMGNSRGNTWSRKHKTLVSQDEFWAFSYDEMAKYDLPASINFIL
P38571 VVFLQHGGLADSSNNVTNLANSLSGLFILADAGFDVVMGNSRGNTWSRKHKTLVSQDEFWAFSYDEMAKYDLPASINFIL
Q96EJ0 VVFLQHGGLADSSNNVTNLANSLSGLFILADAGFDVVMGNSRGNTWSRKHKTLVSQDEFWAFSYDEMAKYDLPASINFIL
P07098 VVFLQHGGLADSSNNVTNLANSLSGLFILADAGFDVVMGNSRGNTWSRKHKTLVSQDEFWAFSYDEMAKYDLPASINFIL

      170     180     190     200     210     220     230     240
NOV1  NKTGQEQVYVGHSGQGTITIGFIASFQIPELAKRIKMFALGPVAVAFCTSPMAKLGRLPDHLIKDLFGDKFELPQSAFL
Q16529 NKTGQEQVYVGHSGQGTITIGFIASFQIPELAKRIKMFALGPVAVAFCTSPMAKLGRLPDHLIKDLFGDKFELPQSAFL
S41408 NKTGQEQVYVGHSGQGTITIGFIASFQIPELAKRIKMFALGPVAVAFCTSPMAKLGRLPDHLIKDLFGDKFELPQSAFL
P38571 NKTGQEQVYVGHSGQGTITIGFIASFQIPELAKRIKMFALGPVAVAFCTSPMAKLGRLPDHLIKDLFGDKFELPQSAFL
Q96EJ0 NKTGQEQVYVGHSGQGTITIGFIASFQIPELAKRIKMFALGPVAVAFCTSPMAKLGRLPDHLIKDLFGDKFELPQSAFL
P07098 NKTGQEQVYVGHSGQGTITIGFIASFQIPELAKRIKMFALGPVAVAFCTSPMAKLGRLPDHLIKDLFGDKFELPQSAFL

      250     260     270     280     290     300     310     320
NOV1  KLASRKLNNKILWMLSEFMSFWASSNKKNNNOLYHSDDEFRANDWQNDADNMKHY
Q16529 KWLGTHVCTHVILKELCGNLCFLLCGFNERNLNMSRVDVYTHSPAGTSVQNMLHWSQAVKFKQAFDWGSSAKNYFHY
S41408 KWLGTHVCTHVILKELCGNLCFLLCGFNERNLNMSRVDVYTHSPAGTSVQNMLHWSQAVKFKQAFDWGSSAKNYFHY
P38571 KWLGTHVCTHVILKELCGNLCFLLCGFNERNLNMSRVDVYTHSPAGTSVQNMLHWSQAVKFKQAFDWGSSAKNYFHY
Q96EJ0 KWLGTHVCTHVILKELCGNLCFLLCGFNERNLNMSRVDVYTHSPAGTSVQNMLHWSQAVKFKQAFDWGSSAKNYFHY
P07098 KLASRKLNNKILWMLSEFMSFWASSNKKNNNOLYHSDDEFRANDWQNDADNMKHY

      330     340     350     360     370     380     390     400
NOV1  NQSYPTTYNVKDMVLPTAVWSGGHDNLADVDVYDNIILTOITNLVPHESTPEWEHLDFIWGLDAPWRLYNKIINLMRYKC
Q16529 NQSYPTTYNVKDMVLPTAVWSGGHDNLADVDVYDNIILTOITNLVPHESTPEWEHLDFIWGLDAPWRLYNKIINLMRYKC
S41408 NQSYPTTYNVKDMVLPTAVWSGGHDNLADVDVYDNIILTOITNLVPHESTPEWEHLDFIWGLDAPWRLYNKIINLMRYKC
P38571 NQSYPTTYNVKDMVLPTAVWSGGHDNLADVDVYDNIILTOITNLVPHESTPEWEHLDFIWGLDAPWRLYNKIINLMRYKC
Q96EJ0 NQSYPTTYNVKDMVLPTAVWSGGHDNLADVDVYDNIILTOITNLVPHESTPEWEHLDFIWGLDAPWRLYNKIINLMRYKC
P07098 NQSYPTTYNVKDMVLPTAVWSGGHDNLADVDVYDNIILTOITNLVPHESTPEWEHLDFIWGLDAPWRLYNKIINLMRYKC

```

BLAST analysis was performed on sequences from the Patp database, which is a proprietary database that contains sequences published in patents and patent publications. Patp results include those listed in Table 1E.

5

Table 1E. Patp BLASTP Analysis for NOV1

Sequences producing High-scoring Segment Pairs	Protein/ Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAB66061	Human lysosomal acid lipase protein - Homo sapiens	399	153/297 (51%)	201/297 (67%)	3.9e-108
patp:AAB90783	Human shear stress-response protein SEQ ID NO: 66 - Homo sapiens	399	153/297 (51%)	201/297 (67%)	3.9e-108
patp:AAP60724	Sequence of pregastric lipase - Homo sapiens	398	146/297 (49%)	196/297 (65%)	4.5e-105
patp:AAP60658	Sequence of human pregastric lipase - Homo sapiens	398	146/297 (49%)	196/297 (65%)	4.5e-105

patp:AAW09383	Human gastric lipase protein sequence - Homo sapiens	398	146/297 (49%)	196/297 (65%)	4.5e-105
---------------	--	-----	------------------	------------------	----------

The presence of identifiable domains in NOV1, as well as all other NOVX proteins, was determined by searches using software algorithms such as PROSITE, DOMAIN, Blocks, Pfam, ProDomain, and Prints, and then determining the Interpro number by crossing the domain match (or numbers) using the Interpro website (<http://www.ebi.ac.uk/interpro>). DOMAIN results for NOV1 as disclosed in Tables 1F, were collected from the Conserved Domain Database (CDD) with Reverse Position Specific BLAST analyses. This BLAST analysis software samples domains found in the Smart and Pfam collections.

Table 1F lists the domain description from DOMAIN analysis results against NOV1. This indicates that the NOV1 sequence has properties similar to those of other proteins known to contain these domains. For Table 1F and all successive DOMAIN sequence alignments, fully conserved single residues are indicated by black shading or by the sign (|) and “strong” semi-conserved residues are indicated by grey shading or by the sign (+). In a sequence alignment herein, fully conserved single residues are calculated to determine percent homology, and conserved and “strong” semi-conserved residues are calculated to determine percent positives. The “strong” group of conserved amino acid residues may be any one of the following groups of amino acids: STA, NEQK, NHQK, NDEQ, QHRK, MILV, MILF, HY, FYW.

Table 1F. Domain Analysis of NOV1							
PSSMs producing significant alignments:				Score(bits)		Evalue	
abhydrolase alpha/beta hydrolase fold				64.8		1.8e-15	
Parsed for domains:							
Model	Domain	seq-f	seq-t	hmm-f	hmm-t	score	E-value
-----	-----	-----	-----	-----	-----	-----	-----
abhydrolase	1/1	111	366 ..	1	232 []	64.8	1.8e-15
Alignments of top-scoring domains:							
abhydrolase: domain 1 of 1, from 111 to 366							
(SEQ ID NO:66)		frvillDlrGfGeSsp.....sdlaeyrfddlaedleal					
		++ ++++    + ++++ +++++ ++     ++ +					
NOV1	111	YDVWVGNSRGNTWSRRhktlsetdekfwafGFDEMAKYDLPGVIDFI 157					
		ldalglekpvilvGhSmGGaialayaakyPel..rvkalvlvspp....					
		+++ +   ++ +   + ++ ++ + ++     + ++  +++  + +					
158		VNKTGQEK-LYFIGHSLGTTIGFVAFSTMPLeaRIKMNFALGPTisfky 206					
		.....lpaglssdlfprqgnleglllanfrnrlsrsveallgralkqff					



```

      +++ + +++|++ +++++ +++|++|+      ++ +++++ ++
207  ptgiftRFFLLPNSIIKAVFGTKGFFLEDKKT--KIASTKICNNKI--LW 252

      llgrplvsdfkqaedwlsslirggeddggdglgaavalgkllqwdls.
      | +++++| + +++ ++|++ | +++|+++ |++ + +++++ +++
253  LICSEFMSLWAGSNKKNMNQLYHSDEFRAWDGNDADNMKHYNQSHPPiY 302

      alkdikvPtlviwgtDplvpldaseklsalipn.aevvviddagHlall
      +|+ +||| ++ |++| ||++++ ++ |++ + +++++|+ | + +
303  DLTAMKVPTAIWAGGHVLTVPQDVARILPQIKSlHYFKLLPDWNHFDV 352

      ekpeevaeli.kfl<-*
      ++ ++ +++++
353  WGLDAPQRMYSII 366

```

The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies.

## 5 NOV2

A disclosed NOV2 nucleic acid (SEQ ID NO:3) of 12348 nucleotides (also referred to as 20708613\_EXT1) encoding a novel MEGF/FLAMINGO/Cadherin-like protein is shown in Table 2A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 1-3 and ending with a TGA codon at nucleotides 12346-12348. The start and stop

10

**Table 2A. NOV2 nucleotide sequence (SEQ ID NO:3).**

```

ATGGCGAGGCGGCCGCCGTGGCGGGCCTCGGGGAACGGTCGACCCCATACTCTGCTCCTTC
TCCTCTCTTTGTTCCCCCTCAGCCAGGAGGAGCTGGGGGGCGGTGGGCACCAGGGCTGGGACCC
AGGCTTAGCTGCCACTACGGGGCAAGGGCGCATATCGGTGGCGGAGCCTTAGCTCTTTGTCCG
GAGTCTTCCGGGTCCGGGAGGATGGGGGGCCTGGCCTGGGGGTGAGGAGCCTATCTTCGTGG
GGCTCCGAGGGAGAAGGCAAAGCGCCCCGAATAGTCGAGGGCCCCCTGAGCAGCCGAATGAGGA
GCTGGGGATTGAACACGGCGTCCAGCCATTGGGCAGCCGGAACGAGAGACAGGACAGGGACCA
GGGTCTGTGTATACTGGCGCCAGAGGTCTCCTCTTGCGGGCGGACAGGACCTTTGCAAAGAG
GTAGTCTGTACACAGGGGCTCTGTCTCAGGGGTCCCGGGCTCGGGGAACAGCTCGCCCCCTCC
TTCAGACTTTTGTATTGCGCACCCAGGTCCCAAGCCGGTGTCTCCAGCGGAACGCTGGGACA
GGCTCCCGCAAAAGAGTGGGCACCGCGCTGTGTGGGAATTATGGGCAACAGGGAGCAAGG
GTCAGGGCGAGAGGCCACGACATCCGGAGCAGAAAGGACAGCCCCCGCGGAACCTGTCTTCC
AGGGGCCCTCGGGATCTGGCCCCGAGCTGGATTGAGCACCACGACGGCGAGGACAGCTCCTGCA
TCAGGTTGAGCAGCCCGCGAGTCTCGGACAGCTCCCGAGCCGGCGCCCAAGCGCATGCGCTCCC
GGGGTCTCTTCCGCTGCCGCTTCTCCCGCAGCGCCCCGGGCCGCGTCCCCGGGACTCCCGGC
CCGTCTGAAGCCAGGAAAGTAACCTCGGCGAACCGGGCACGCTTTCGTGCGCGCCGAAACCGC
CACCCGCAGTTTCCGCAGTACAACTACCAGACGCTGGTGCCGGAGAATGAGGCAGCAGGCACCG
CGGTGCTACGCGTGTTGCTCAGGACCCGACGCCGGCGAGGCCGGGGCGCTAGTCTACTCGCT
GGCGGCACTCATGAACAGCCGCTCGCTGGAGCTGTTGAGCATCGACCCGACAGCGGCCCTTATC
CGTACGGCGGCAGCTCTGGACCGCGAGAGCATGGAGCGTCACTACCTGCGTGTGACCGCGCAGG
ACCACGGGTGCGCGCGCTCTCGGCCACCACGATGGTGGCCGTGACAGTAGCCGACCGCAACGA
CCACTCGCCGTTTGTGAGCAAGCGCAGTACCGGGAGACCTTCGCGAGAATGTGGAGGAGGGC
TACCCTATCCTGCAGCTGCGTGCCACTGACGGCGACGCGCCCCCAACGCCAACCTGCGCTACC

```

[illegible]

CGGACACGGGCAACGCAGGGGGTCTGATGCAAGTGCAGGCTGGGCCACACAGCACGCTCCTTT  
 GCCAGCTAGATCGGGGGTTACTGTCTGTGACAGTGACCAGGGGCTCGGGCCGTGCTTCCCATCT  
 CTTTCTGGACCAGGTGACTGTCTAGTGATGGCCGGTGGCACGATCTGCGGCTGGAGTTGCAGGAG  
 GAACCAGGTGGCCGGCGGGGCCACCATGTCTTATGGTCTCACTGGACTTTAGCCTCTTCCAGG  
 ACACCAGTGGCGGTGGGGAGTGAGCTGCAGGGCCCTGAAGGTAAGCAGCTCCACGTGGGAGGCCT  
 GCCCCCGGCAGTGACAGGAGGCTCCTCAGGGTCTGGTTGGCTGCATCCAGGGGGTGTGGCTC  
 GGCTCCACACCTCTGGCTCCCCGGCCCTGCTACCCCCAGCCACCGAGTGAATGCGGAGCCTG  
 GCTGTGTTGTGACCAACGCCTGTGCCTCTGGGCCCTGCCACCTCACGCAGACTGCCGGGACCT  
 CTGGCAGACCTTTTCTTGACCTGCCAGCCAGGTTACTACGGCCAGGCTGTGTGGATGCCTGC  
 CTCCTGAACCCCTGTGAGAACCAGGGATCATGCCGGCACCTGCCAGGAGCCCCCATGGCTATA  
 CCTGTGACTGTGTGGGTGGCTATTTCCGGGCACCACTGTGAGCACAGGATGGACCAGCAGTGCCC  
 ACGGGGCTGTGGGGGAGCCCACTGTGGCCCCCTGCAACTGTGATGTTCAAAAGGTTTTGAT  
 CCAACTGCAACAAGACAAATGGGCAGTGTCACTGCAAGGAGTTTCACTACCGACCGCGGGGCA  
 GTGACTCTTGCTCCCATGTGACTGCTACCCTGTGGGCTCCACCTCGCGCTCATGTGCACCCCA  
 CAGCGGGCAGTGCCCTGTGCGCCAGGAGCCCTTGGCCGCCAGTGCAACAGCTGTGACAGTCCC  
 TTCGCAGAGGTGACAGCCAGCGGCTGCCGGGTGCTCTATGATGCCTGCCCTAAGTCCCTGAGAT  
 CTGGTGTGTGGTGGCCCCAGACAAAGTTTGGCGTCTCGGCCACAGTGCCCTGTCCCCGGGGGGC  
 CCTGGGTGCTGCTGTGCGGCTGTGTGATGAGGCCAGGGTGGCTGGAGCCCGACCTCTTCAAC  
 TGTACCTCCCCTGCCTTTTCGAGAGCTCAGTCTGCTGCTGGATGGCCTAGAGCTGAACAAGACGG  
 CACTGGATACCATGGAGGCCAAGAAGCTGGCTCAGCGGCTACGGGAGGTGACTGGCCACACTGA  
 CCACTATTTAGCCAAGATGTTGAGTCACTGCCCGCTGCTGGCCACCTGCTGGCCTTCGAG  
 AGCCATCAGCAGGGCTTCCGGCTGACAGCCACACAGGATGCCCACTTCAATGAGAATCTGCTGT  
 GGGCCGGCTCTGCACTGCTTGCCCCAGAGACAGGGGACTTGTGGGCGGCGCTGGGGCAGCGGGC  
 CCTTGGGGCTCCCCAGGCAGCGGGGACTGGTGAGGCACCTGGAGGAGTATGCAGCCACACTC  
 GCAAGGAATATGGAATCACATACCTGAATCCATGGGGCTGGTGACGCCTAATATCATGCTCA  
 GCATTGACGCATGGAGCACCCAGTTCTCCCCGGGGGGCGCTCGCTACCTCTGCTACCATAG  
 CAACCTCTTTCGAGGCCAGGATGCCTGGGATCCTCACACCCATGTGCTGCTGCCTTCCCAGTCC  
 CCACGGCCATCCCCATCTGAAGTTCTGCCCACAAGCAGCAGCATAGAAAATCCACCACCTCAA  
 GTGTGGTCCCCCACCAGCCCCGCCAGAGCCAGAGCCTGGGATCTCCATTATCATTCTCCTCGT  
 TTACCGCACCTTAGGGGGACTGCTCCCTGCCAGTTCCAGGCAGAACGCCGAGGTGCCAGGCTT  
 CCTCAGAACCCCGTCTGAATCCCCCGGTGGTCAAGCTGGCTGTGTTCCACGGACGCAACTTCC  
 TAAGGGGAATCCTGGAGTCCCCCATCAGCCTAGAGTTTTCGCTGCTACAGACAGCGAATCGGAG  
 CAAGGCGATCTGTGTGAGTGGGACCCACCTGGCCTGGCGGAGCAGCATGGTGTGTGGACAGCA  
 CGGGACTGCGAGCTGGTGACAGGAATGGGTCCACGCACGGTGTGCTGACGCCGAGCGGACAGGA  
 CTTTGGGGTCTCATGGATGCCTCTCCCCGTGAGAGGCTGGAGGGCGACCTGGAGCTGCTGGC  
 TGTGTTACCCACGTGGTCTGTGGCTGTGTCTGTGGCTGCGCTGGTGTGCTGACTGCAGCCATCCTG  
 CTGAGCCTGCGCAGCCTCAAGTCCAATGTGCGTGGGATCCATGCCAATGTGGCAGCCGCCCTGG  
 GGGTGGCAGAGCTCCTCTTCTGCTGGGGATTACAGGACCCACAATCAGGTGCAGGATCAGGG  
 CCAGGGAACTTGTGTCTGATGACCCTACTGGCCCCAGGAGGCTGGGGCCAAAATCAGGGTCA  
 GAGCTGGTGTGCACTGCAGTCGCCATCCTCCTGCACTACTTCTTCTCAGCACCTTCGCGTGGC  
 TCTTCGTGACAGGGGCTGCACCTCTACCGCATGCAGGTTGAGCCACGCAACGTGGACCGCGGCGC  
 CATGCGCTTCTACCATGCCCTGGGCTGGGGCGTCCCTGCTGTGCTGCTGGGCTTCTGTGGGCT  
 CTGGACCTTGGAGCTATGGGAACCTGACTTCTGCTGGATCTCAGTCCACGAGCCCTCATCT  
 GGAGCTTGTGCTGGCCCTGTTGTCTGGTCAAGTGAACCGGACCATGTTTCTCCTCGCTGC  
 CCGCACATCCTGCTCCACAGGGCAGAGGGAGGCCAAGAAGACCTCTGCACTCAGGACCTTTCGC  
 AGCTCCTTCTGCTGCTTCTGCTGGTCAAGTGCCTCCTGGCTCTTGGGCTCCTGGCAGTCAACC  
 ACAGCATCCTAGCCTTCCACTACCTCCATGCTGGACTCTGCGGCTCCAGGGCTGGCGGTGCT  
 GCTGCTCTTCTGTGCTCTAAATGCAGATGCTCGGGCTGCCTGGATGCCAGCCTGTCTGGGCAGG  
 AAGGCAGCGCTGAGGAGGCAAGGCCAGCACCTGGGCTGGGACCTGGGGCTACAACAACACGG  
 CTCTCTTTGAGGAGAGTGGCCTCATCCGCATCACTCTGGGCGCCTCCACCGTCTCCTCTGTGAG  
 CAGTGCCCGCTCCGGCCGGACCCAGGACCAGGACAGCCAGCGGGGCGCAGCTACCTCAGGGAC  
 AATGTCCTGGTTTCGACATGGCTCAGCCGCTGACCACACTGACCACAGCCTCCAGGCTCATGCTG  
 GCCCCACTGACCTGGACGTGGCCATGTTCCATCGAGATGCTGGCGCAGACTCCGACTCTGACAG  
 TGACCTGTCTTGGAGGAGGAGAGGAGTCTCTCCATTCCATCTTCAAGGCGAGGACAATGGC  
 CGGACGCGGGGGCGCTTCCAACGGCCACTCTGCCGAGCAGCCAGAGTGAGAGGCTCCTCACCC  
 ACCCCAAAGATGTGGATGGCAATGACCTCCTGTCTTACTGGCCAGCCCTGGGGGAGTGCGAGGC  
 AGCCCCCTGTGCTCTGCAGACTTGGGGCTCTGAAAGGCGCCTGGGGCTGGACACCAGCAAGGAT  
 GCAGCTAACAACAACCAGCCAGACCCGGCCCTGACCAGTGGGGATGAGACTTCTCTGGGCGGGG  
 CCCAGCCCTGAGCTGCTTGGTGGCGGTGAGCCACCTTGGGCCACCGTGCAGTGCCAGCTGCC  
 TCTTACGCTGCGATCTATGCTGGCGGGGACGGGCAGCCTTTACAGCCAGCCAGCCGCTACT  
 CTTCTAGAGAACAGCTGGACCTGCTCCTCCGGCGGCAACTGAGCCGTGAGCGACTAGAGGAAGC

CCCTGCCCTGTTCTACGTCCCCTGAGCCGGCCAGGGTCCCAGGAATGCATGGATGCTGCACCA  
GGCCGACTGGAGCCCAAAGATCGGGGACGACCCCTGCCACGGAGGCAGCCACCTCGGGACTACC  
CTGGGCCCATGGCTGGCCGCTTCGGGTACGGGATGCGCTCGACTTAGGGGCACCTCGAGAGTG  
GTTGAGCAGCTGCCTCCGCCCCGCCGACCCGGGACCTTGACCCACAGCCCCACCTCTGCCC  
CTGTCTCCCCAGCGCAACTCTCAAGGGACCCCTCTTGCCATCCCGGCCGCTGGACTCTCTGT  
CTAGGAGCTCGAACTCTCGGGAGCAGCTGGACCAGGTGCCTAGCCGGCACCCTCACGAGAAGC  
CCTTGGGCCACTCCCGCAGCTGCTCAGAGCTAGGGAGGACTCGGTCACTGGCCCCAGCCATGGC  
CCCTCCACAGAACAGTTGGACATTCTTTCCTCCATCCTTGCCCTCTTCAACTCCTCGGCCCTCT  
CCTCTGTGCAATCTTCAAGCACACCCTTGGGCCCTCACACCCTGCCACACCTTCTGCCACAGC  
CTCTGTGCTTGGGCCCTCCAGCCACGTTCTGCCACGTCTCACAGCATCTCGAGCTGTCGCCA  
GACTCAGAACCGAGGGACACACAGGCAGTGTCTGCAACACAAGCAATGGACCTGCGGAGGC  
GAGACTACCACATGGAACGGCCGCTGCTGAACCAGGAGCATTGGAGGAGCTGGGGCGCTGGGG  
CTCAGCACCTAGGACCCACAGTGGCGGACCTGGTTGCACTGCTCCCGTCTCGGGCCTATGCC  
CTTCTGCTCCAACACCTCCCGGTTTTGGTCTGGTTACCCCGGTATCCTGTGCGTGACTGGCTCC  
TGGGTGACCTGTTATCCGGCCTGAGTGTGGCCATCATGCAGCTTCCGAGGGCTTGGCCCTACGC  
CCTCCTGGCTGGATTGCCCCCGTGTTTGGCCTCTATAGCTCCTTCTACCCTGTCTTCTATCTAC  
TTCCTGTTTGGCACTTCCCGGCACATCTCCGTGGAGAGCCTCTGTGTCCCGGGACAGTAGACA  
CAGGGACCTTTGCTGTCTGTCTGTGATGGTGGGCAGTGTGACAGAATCCCTGGCCCCGAGGC  
CTTGAACGACTCCATGATCAATGAGACAGCCAGAGATGCTGCCCGGGTACAGGTGGCCTCCACA  
CTCAGTGTCTGTTGGCCTCTTCCAGGTGGGGCTGGGCCTGATCCACTTCGGCTTCGTGGTCA  
CCTACCTGTCTAGAACCTCTTGTCCGAGGCTATACCACAGCTGCAGCTGTGAGGTCTTCTGTCTC  
ACAGCTCAAGTATGTGTTTGGCCTCCATCTGAGCAGCCACTCTGGGCCACTGTCCCTCATCTAT  
ACAGTGTGAGGTCTGCTGGAAGCTGCCCCAGAGCAAGGTTGGCACCGTGGTCACTGCAGCTG  
TGGCTGGGGTGGTGTCTCGTGGTGGTGAAGCTGTTGAATGACAAGCTGCAGCAGCAGTGGCCAT  
GCCGATACCCGGGGAGCTGCTCAGCTCATCGGGGCCACAGGCATCTCCTATGGCATGGGCTTA  
AAGCACAGATTTGAGGTAGATGTCGTGGGCAACATCCCTGCAGGGCTGGTGCCCCAGTGGCCC  
CCAACACCCAGCTGTTCTCAAAGCTCGTGGGCAGCGCCTTACCATCGTGTGGTTGGGTTTGC  
CATTGCCATCTCACTGGGGAAGATCTTCCGCCCTGAGGCACGGCTACCGGTGGACAGCAACCAG  
GAGCTGGTGGCCCTGGGCCTCAGTAACCTTATCGGAGGCATCTTCCAGTGTCTCCCGTGAGTT  
GCTCTATGTCTCGGAGCCTGGTACAGGAGAGCACCGGGGGCAACTCGCAGGTGTCTGGAGCCAT  
CTCTTCCCTTTTCTATCCTCCTCATCATTGTCAAACCTTGGGGAACCTTCCATGACCTGCCCAAG  
GCGTCTTGGCAGCCATCATCATTGTGAACCTGAAGGGCATGCTGAGGCAGCTCAGCGACATGC  
GCTCCTCTGGAAGGCCAATCGGGCGGATCTGCTTATCTGGCTGGTGACCTTACGGGCCACCAT  
CTTGCTGAACCTGGACCTTGGCTTGGTGGTTGCGGTCACTTCTCCCTGTGCTCGTGGTGGTC  
CGGACACAGATGCCCCACTACTCTGTCTTGGGGCAGGTGCCAGACACGGATATTTACAGAGATG  
TGGCAGAGTACTCAGAGGCCAAGGAAGTCCGGGGGGTGAAGGTCTTCCGCTCCTCGGCCACCGT  
GTACTTTGCCAATGCTGAGTTCTACAGTGATGCGCTGAAGCAGAGGTGTGGTGTGGATGTGAC  
TTCTCTATCTCCAGAAGAAGAACTGCTCAAGAAGCAGGAGCAGCTGAAGCTGAAGCAACTGC  
AGAAAGAGGAGAAGCTTCGGAACAGGCAGGGCCCCCTTTGTCTGCATGTCTGGCTCCCCAGCA  
GGTGAGCTCAGGAGATAAGATGGAAGATGCAACAGCCAATGGTCAAGAAGACTCCAAGGCCCA  
GATGGGTCCACACTGAAGGCCCTGGGCCTGCCTCAGCCAGACTTCCACAGCCTCATCCTGGACC  
TGGGTGCCCTCTCCTTTGTGGACACTGTGTGCCTCAAGAGCCTGAAGAATATTTCCATGACTT  
CCGGGAGATTGAGGTGAGGTGTACATGGCGGCCTGCCACAGCCCTGTGGTTCAGCCAGCTTGAG  
GCTGGGCACTTCTTCGATGCATCCATACCAAGAAGCATCTCTTGCCTCTGTCCATGATGCTG  
TCACCTTTGCCCTCCAACACCCGAGGCCTGTCCCGACAGCCCTGTTTCGCCCTCACTCGCTGT  
CTCCTCAGATGTGAAACAGTTGGAACCAGAGCTGCTTCTCAGGAATAATTGCTCTCAGGAATA  
CCCCGAAAGGTACAGGGCAGCGTGGGTGCCAATGGGCAGTCCCTGGAGGATACAGAGTGA

The chromosomal locus for 20708613\_EXT1 is 3p21.3-4. This information was assigned using OMIM, the electronic northern bioinformatic tool implemented by CuraGen Corporation, public ESTs, public literature references and/or genomic clone homologies. This was executed to derive the chromosomal mapping of the SeqCalling assemblies, Genomic clones, literature references and/or EST NOVX sequences that are included in the invention.

In a search of sequence databases, it was found, for example, BlastX analysis of 20708613\_EXT1 showed that there was 94% (2449/2599 bp) homology to Rattus norvegicus protein MEGF (SPTREMBL-ACC:O88278). MEGF stands for multiple epidermal growth

factor repeat containing protein. 20708613\_EXT1 also showed 70% (1684/2384 bp) homology to Mus musculus protein FLAMINGO 1 (TREMBLNEW-ACC: BAA84070).

A disclosed NOV2 polypeptide (SEQ ID NO:4) encoded by SEQ ID NO:3 has 4115 amino acid residues and is presented in Table 2B using the one-letter amino acid code. NOV2 is likely a Type IIIa membrane protein (clv). SignalP, Psort and/or Hydropathy results predict that NOV2 has a signal peptide and is likely to be localized plasma membrane with a certainty of 0.8200. In an alternative embodiment, NOV2 is likely to be localized to the Golgi body with a certainty of 0.4600, or to the endoplasmic reticulum (membrane) with a certainty of 0.3700, or to the endoplasmic reticulum (lumen) with a certainty of 0.1000. The most likely cleavage site for a NOV2 peptide is between amino acids 31 and 32, *i.e.*, at the dash between amino acids SQE-EL.

**Table 2B. Encoded NOV2 protein sequence (SEQ ID NO:4).**

```
MARRPPWRGLGERSTPILLLLLLLSLFLSQEELGGGGHQWDPGLAATTGPAHIGGGALALCP
ESSGVREDGGPGLGVREPIFVGLRGRQRSARNSRGPPEQPNEELGIEHGVQPLGSRERETGQGP
GSVLYWRPEVSSCGRTGPLQRGSLSPGALSSGVPGSGNSSPLPSDFLIRHHGPKPVSSQRNAGT
GSRKRVGTARCCGELWATGSKGQGERATTSGAERTAPRRNCLPGASGSGPELDSAPRTARTAPA
SGSAPRESRTAPEPAPKMRMRSGLFRCLPQRPGRPPGLPARPEARKVTSANRARFRRAANR
HPQFPQYNYQTLVPENEAAGTAVLRVVAQDPDAGEAGRLVYSLAALMNSRSLELFSIDPQSLI
RTAAALDRESMERHYLRVTAQDHGSPRLSATTMVAVTVADRNDHSPVFEEQAQYRETLRENVEEG
YPILQLRATDGAPPNANLRYRFVGPAAARAAAAAFEIDPRSGLISTSGRVDREHMESYELVV
EASDQGGQEPGRSATVRVHITVLDENDNAPQFSEKRYVAQVREDVRPHTVVLRVVTATDRDKDAN
GLVHYNIISGNSRGHFAIDSLTGEIQVVAPLDFAEREYALRIRAQDAGRPPLSNNTGLASIQV
VDINDHIPIFVSTPFQVSVLENAPLGHSVIHIQAVDADHGENARLEYSLTGVAPDTPFVINSAT
GWVSVSGPLDRESVEHYFFGVEARDHGSPPLSASASVTVTVDVNDNRPEFTMKEYHLRLNEDA
AVGTSVSVSVTAVDRDANS AISYQITGNTNRNFAISTQGGVGLVTLALPLDYKQERYFKLVLT
SDRALHDHCYVHINITDANTHRPVFQSAHYSVSVNEDRPMGSTIVVISASDDDDVGENARITYLL
EDNLPQFRIDADSGAITLQAPLDYEDQVITYTLAITARDNGIPQKADTTYVEVMVNDVNDNAPQF
VASHYTGLVSEDAPPFTSVLQISATDRDAHANGRVQYTFQNGEDGDGDFTEIPTSGIVRTVRL
DREAVSVYELTAYAVDRGVPLRTPVSIQVMVQDVNDNAPVFPAEEFEVRVKENSIVGSVVAQI
TAVDPDEGPNAHIMYQIVEGNIPELFQMDIFSGELTALIDLDEARQEYVIVVQATSAPLVSRA
TVHVRLVDQNDNSPVLNMFQILFNYSVNSRSDTFPSGIIGRIPAYDPDVSDDLFSYFERNELQ
LLVNVQTSSELRLSRKLDNNRPLVASMLVTVDGLHSVTAQCVLRVVIITEELLANSITVRLN
MWQERFLSPLLGRFLEGVA AVLATPAEDVFI FNIQNDDTVGGTVLNVFSFALAPRGAGAGAAGP
WFSSEELQEQLYVRAALAARSLDLVLPFDDNVCLREPCENYMKCVSVLRFDSAPFLASATL
FRPIQPIAGLRCPGPFTGDFCETELDLCSNPCRNGGACARREGGYTCVCRPFTGEDCELD
TEAGRCVPGVCRNGGTCTDAPNGGFRQCPCAGGAFEGPRCEVAARSFPPSSFVMFRGLRQRFHL
TSLSLFATVQQSGLLFYNGRLNEKHDFLALVLVAGQVRLTYSTGESNTTVVSPTVPGLSDGQWH
TVHLRYYNKPRTDALGGAQGPSKDKVAVLSVDDCDVAVALQFGAEIGNYSCAAAGVQTSSKKSL
DLTGPLLLGGVPNL PENFPVSHKDFIGCMRDLHIDGRRVDMAAFVANNGTMAGCQAKLHFCDSG
PCKNSGFCSEWRGFSFSCDCPVGFGGKDCQLTMAHPHHFRNGTLSWNFGSDMAVSVPWYLG LAF
RTRATQGVLMQVQAGPHSTLLCQLDRGLLSVTVTRGSGRASHLLLDQVTVSDGRWHDRLRELQE
EPGGRRGHHVLMVSLDFSLFQDTMAVGSELQGLKVKQLHVGGLPPGSAEEAPQGLVGCIQGVWL
GSTPSGSPALLPPSHRVNAEPGCVVTNACASGCPPHADCRDLWQTFSCCTCPGYYGPGCVDAC
LLNPNQNGSCRHLPGAPHGYTDCVGGYFGHHCEHRMDQQCPRGWWSPTCGPCNCDVHKGFD
PNCNKTNGQCHCKEFHYRPRGSDSCLPCDCYPVGSTSRSCAPHSGQCPCRPALGRQCNSCDSP
FAEVTASGCRVLYDACPKSLRSGVWWPQTKFVGLATVPCPRGALGA AVRLCDEAQGWLEPDLFN
CTSPAFRELSLLLDGLELNKLTALDTMEAKKLAQRLREVTGHTDHYFSQDVRVTARLLAHLAFE
SHQQGFGLTATQDAHFNENLLWAGSALLAPETGDLWAALGQRAPGGSPGSAGLVRHLEEYAATL
ARNMELTYLNPMLVTPNIMLSIDRMEHPSSPRGARRYPRYHSNLFRRQDAWDPTHVLLPSQS
PRPSPSEVLPTSSSIENSTTSSVPPPPAPPEPEPGISIIILLVYRTLGGLLPAQFQAERRGARL
PQNPVMNSPVVSVAVFHGRNFLRGILESPISLEFRLLQTANRSKAI CVQWDPGLAEQHGVTWA
RDCELVHRNGSHARCRCRTGTGFGVLM DASPRERLEGDLELLAVFTHVVVAVSVAALVLTAAIL
```

```

LSLRSLKSNVRGIHANVAAALGVAELLFLLGIHRTNQQVQDQGGTCVLMTLLAQEAWGQNSGS
ELVCTAVAILLHYFFLSTFAWL FVQGLHLYRMQVEPRNVDRGAMRFYHALGWGVPVAVLLGLAVG
LDPEGYGNPDFCWI SVHEPLIWSFAGPVVLVIVMNGTMFLLAARTSCSTGQREAKKTSALRTL R
SSFLLLLLVASWLFGLLAVNHSILAFHYLHAGLCGLQGLAVLLLFCVLNADARAAMPACLGR
KAAPEEARPAPGLGPGAYNNTALFEESGLIRITL GASTVSSVSARSGR TQDQDSQRGRSYLRD
NVLVRHGSAADHTDHSLOAHAGPTDL DVAMFHRDAGADSDSDLSLEERSLSIP SSESEDNG
RTRGRFQRP LCRAAQSERLLTHPKDVGNDLLSYWPALGECEAAPCALQTWGSERRLGLDTSKD
AANNQPPDPALTSGETSLGRAQRQRKGILKNRLQYPLVPQTRGAPELSWCRAATLGHRAPAA
SYGRIYAGGGTGSLSQPASRYSSREQLDLLRRQLSRERLEEAPAPVLRPLSRPGSQECMDAAP
GRLEPKDRGSTLPRRQPPRDYPGAMAGRFGSRDALDLGAPREWLSTLPPPRTRDLDPQPPPLP
LSPQRQLSRDPLLP SRPLDSLRSNSREQLDQVPSRHSREALGPLPQLLRAREDSVSGPSHG
PSTEQLDILSSILASFNSSALSSVQSSSTPLGPHTTATPSATASVLGPSTPRSATSHSISELSP
DSEPRDTQALLSATQAMDLRRRDYHMERPLL NQEHLEELGRWGSAPRTHQWRTWLQCSRARAYA
LLLQHL PVLVWLP RYPVRD WLLGDLLSGLSVAIMQLPQGLAYALLAGLPPVFGLYSSFPVFIY
FLFGTSRHISVESLCVPGPVD TGTFAVMSVMVGSVTESLAPQALNDSMINETARDAARVQVAST
LSVLVGLFQVGLGLIHFGFVVTYLSEPLVRGYTTAAAVQVFVSQ LKYVFGHLSSHSGPLSLIY
TVLEVCWKLPQSKVGT VVTA AVAGVVLVVVKLLNDK LQQQLPMP IPGELLTLIGATGISYGMGL
KHRFEVDVVGNI PAGLVPPVAPNTQLFSKLVGSAFTIAVVGFAIAISLGKIFALRHGVRVDSNQ
ELVALGLSNLIGGI FQCFPVSCSMSRSLVQESTGGNSQVAGAISSLFILLIIVKL GELFHDLPK
AVLAAIIIVNLKGMLRQLSDMRSLWKANRADLLIWLVTFTATILLNLDLGLVVAVIFSLLLVVV
RTQMPHYSVLGQVPD TDIYRDVAEYSEAKEVRGVKVFRRSATVYFANA EFYSDALKQRCGVDVD
FLISQKKKLLKKQEQLK LKQLQKEEKL RKQAGPLLSACLAPQQVSSGDKMEDATANGQEDSKAP
DGSTL KALGLPQPDFHSLILD LGALS FVDTVCLKSLKNIFHDFREIEVEVYMAACHSPVVSQLE
AGHFFDASITKKHLFASVHDAVTFALQHPRVPD SPVSPSLAVSSDVKQLEPELLLRNNLLSGI
PEKVQGSVGANGQSLEDTE

```

The full amino acid sequence of the protein of the invention was found to have 2376 of 2599 amino acid residues (91%) identical to, and 2449 of 2599 residues (94%) positive with, the amino acid residue protein from *Rattus norvegicus* ptnr: SPTREMBL-ACC:O88278 MEGF2.

In a further search of public sequence databases, NOV2 was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 2C.

Table 2C. BLASTP results for NOV2					
Gene Index/ Identifier	Protein/ Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SPTREMBL- ACC:Q9NYQ7	PROTODHERIN FLAMINGO 1 - Homo sapiens	3312	2601/2618 (99%)	2604/2618 (99%)	0.0
ptnr:SPTREMBL- ACC:Q91ZIO	CADHERIN EGF LAG SEVEN- PASS G-TYPE RECEPTOR - Mus musculus	3301	2392/2618 (91%)	2469/2618 (94%)	0.0
ptnr:SPTREMBL- ACC:O88278	MEGF2 - <i>Rattus norvegicus</i>	3313	2376/2599 (91%)	2449/2599 (94%)	0.0
ptnr:SPTREMBL- ACC:Q9HCU4	FLAMINGO 1 - Homo sapiens	2923	1345/2330 (57%)	1681/2330 (72%)	0.0
ptnr:SPTREMBL- ACC:Q9ROM0	FLAMINGO 1 - Mus musculus	2920	1348/2384 (56%)	1684/2384 (70%)	0.0

The homology of these sequences is shown graphically in the ClustalW analysis shown in Table 2D. The NOV2 polypeptide is provided in lane 1.

Table 2D. ClustalW Analysis of NOV2	
1)	NOV2 (SEQ ID NO:4)

- 2) Q9NYQ7 (SEQ ID NO:67)
- 3) Q91ZIO (SEQ ID NO:68)
- 4) O88278 (SEQ ID NO:69)
- 5) Q9HCU4 (SEQ ID NO:70)
- 6) Q9R0M0 (SEQ ID NO:71)

```

      10      20      30      40      50      60      70      80
NOV2  -MARPPMRGIGERSTPILLLLLLLSLFFLSDEELGGGCHGCDWDPGATTTGPAHICCGAALCPSSSVREDGCPGLGV
Q9NYQ7 MMARRPPMRGIGERSTPILLLLLLLSLFFLSDEELGGGCHGCDWDPGATTTGPAHICCGAALCPSSSVREDGCPGLGV
Q91ZIO -MARRPLAWGLCPSTPILLLLLLLSLFFFSREELGGGCHGCDWDPGATTTGPAHICCGAALCPSSSVREDGCPGLGV
O88278 -MARRPLAWGLCPSTPILLLLLLLSLFFFSREELGGGCHGCDWDPGATTTGPAHICCGAALCPSSSVREDGCPGLGV
Q9HCU4 -MRSPATGVPLPFPFILLLLLLLSLFFLSDEELGGGCHGCDWDPGATTTGPAHICCGAALCPSSSVREDGCPGLGV
Q9R0M0 -MRTAASAPLETILLLLLLLSLFFFSREELGGGCHGCDWDPGATTTGPAHICCGAALCPSSSVREDGCPGLGV

      90      100     110     120     130     140     150     160
NOV2  REPPIFVGLGRROGARNRQPPQPNELGIEHCVPPLGSRRETCGGPGSVLYRRPEVSSCGRTGPIRGSLSPGALS
Q9NYQ7 REPPIFVGLGRROGARNRQPPQPNELGIEHCVPPLGSRRETCGGPGSVLYRRPEVSSCGRTGPIRGSLSPGALS
Q91ZIO REPPIFVGLGRROGARNRQPPQPNELGIEHCVPPLGSRRETCGGPGSVLYRRPEVSSCGRTGPIRGSLSPGALS
O88278 REPPIFVGLGRROGARNRQPPQPNELGIEHCVPPLGSRRETCGGPGSVLYRRPEVSSCGRTGPIRGSLSPGALS
Q9HCU4 REPPIFVGLGRROGARNRQPPQPNELGIEHCVPPLGSRRETCGGPGSVLYRRPEVSSCGRTGPIRGSLSPGALS
Q9R0M0 REPPIFVGLGRROGARNRQPPQPNELGIEHCVPPLGSRRETCGGPGSVLYRRPEVSSCGRTGPIRGSLSPGALS

      170     180     190     200     210     220     230     240
NOV2  GVPFGSGNSPLPSDFLIRHHGHPVSSORNAGTSRKRVCARCCGELWATSKGQGERATISGARETAPRRNCLPGAS
Q9NYQ7 GVPFGSGNSPLPSDFLIRHHGHPVSSORNAGTSRKRVCARCCGELWATSKGQGERATISGARETAPRRNCLPGAS
Q91ZIO GDSDLRNSSPHPSSELLAQDGSRPVAFORNARRSIRKRVETSRCCGELWATSKGQGERATISGARETAPRRNCLPGAS
O88278 GDSDLRNSSPHPSSELLAQDGSRPVAFORNARRSIRKRVETSRCCGELWATSKGQGERATISGARETAPRRNCLPGAS
Q9HCU4 HHDGLFVWCPESEAHPLPAPG-----GCP-----ASCRLLSIGHLSPOCKLITLBBEHPCLK
Q9R0M0 HHDGLFVWCPESEAHPLPAPG-----GCP-----ASCRLLSIGHLSPOCKLITLBBEHPCLK

      250     260     270     280     290     300     310     320
NOV2  SGPELDSAPRTAPASGAPRESRTAPEAPKRMRSRGLFRCRELPRPGPRPPGLPARPEAKVTSANARFRRAAN
Q9NYQ7 SGPELDSAPRTAPASGAPRESRTAPEAPKRMRSRGLFRCRELPRPGPRPPGLPARPEAKVTSANARFRRAAN
Q91ZIO SCLGSDSAPRAVRTAPASGAPRESRTAPEAPKRMRSRGLFRCRELPRPGPRPPGLPARPEAKVTSANARFRRAAN
O88278 SCLGSDSAPRAVRTAPASGAPRESRTAPEAPKRMRSRGLFRCRELPRPGPRPPGLPARPEAKVTSANARFRRAAN
Q9HCU4 -----APRLRCQSCKLAQAG-----LAGEGSE-----EBSLG-GARRKNNV
Q9R0M0 -----APRLRCQSCKLAQAG-----LAGEGSE-----EBSLG-GARRKNNV

      330     340     350     360     370     380     390     400
NOV2  RHPQFPQYNYQTLVPENEAAGTVLVRVVAQDPDAGEAGRLVYSLAALMNSRSLFLSIDPQSGLIRTAALDRESMERHY
Q9NYQ7 RHPQFPQYNYQTLVPENEAAGTVLVRVVAQDPDAGEAGRLVYSLAALMNSRSLFLSIDPQSGLIRTAALDRESMERHY
Q91ZIO RHPQFPQYNYQTLVPENEAAGTVLVRVVAQDPDAGEAGRLVYSLAALMNSRSLFLSIDPQSGLIRTAALDRESMERHY
O88278 RHPQFPQYNYQTLVPENEAAGTVLVRVVAQDPDAGEAGRLVYSLAALMNSRSLFLSIDPQSGLIRTAALDRESMERHY
Q9HCU4 TAPQFPQYNYQTLVPENEAAGTVLVRVVAQDPDAGEAGRLVYSLAALMNSRSLFLSIDPQSGLIRTAALDRESMERHY
Q9R0M0 TAPQFPQYNYQTLVPENEAAGTVLVRVVAQDPDAGEAGRLVYSLAALMNSRSLFLSIDPQSGLIRTAALDRESMERHY

      410     420     430     440     450     460     470     480
NOV2  LRVTAQDHGSPRLSATTMVAVTVADRNDHSPVFQEAQYRETLRENVEEGYPILQLRATDGDAPPNANLRYRFVGPAAARA
Q9NYQ7 LRVTAQDHGSPRLSATTMVAVTVADRNDHSPVFQEAQYRETLRENVEEGYPILQLRATDGDAPPNANLRYRFVGPAAARA
Q91ZIO LRVTAQDHGSPRLSATTMVAVTVADRNDHSPVFQEAQYRETLRENVEEGYPILQLRATDGDAPPNANLRYRFVGPAAARA
O88278 LRVTAQDHGSPRLSATTMVAVTVADRNDHSPVFQEAQYRETLRENVEEGYPILQLRATDGDAPPNANLRYRFVGPAAARA
Q9HCU4 FRVTAQDHGMPRRSALATITLITLITDNDHSPVFQEAQYRETLRENVEEGYPILQLRATDGDAPPNANLRYRFVGPAAARA
Q9R0M0 FRVTAQDHGMPRRSALATITLITLITDNDHSPVFQEAQYRETLRENVEEGYPILQLRATDGDAPPNANLRYRFVGPAAARA

      490     500     510     520     530     540     550     560
NOV2  AAAAAFEIDPRSGLISTSGRVDRHMESEYLVVEASDQGEQPGPRSATVRVHITVLDENDNAPQFSEKRYVAQVREDVRF
Q9NYQ7 AAAAAFEIDPRSGLISTSGRVDRHMESEYLVVEASDQGEQPGPRSATVRVHITVLDENDNAPQFSEKRYVAQVREDVRF
Q91ZIO AAAAAFEIDPRSGLISTSGRVDRHMESEYLVVEASDQGEQPGPRSATVRVHITVLDENDNAPQFSEKRYVAQVREDVRF
O88278 AAAAAFEIDPRSGLISTSGRVDRHMESEYLVVEASDQGEQPGPRSATVRVHITVLDENDNAPQFSEKRYVAQVREDVRF
Q9HCU4 SPSEVFEIDPRSGLISTSGRVDRHMESEYLVVEASDQGEQPGPRSATVRVHITVLDENDNAPQFSEKRYVAQVREDVRF
Q9R0M0 SPSEVFEIDPRSGLISTSGRVDRHMESEYLVVEASDQGEQPGPRSATVRVHITVLDENDNAPQFSEKRYVAQVREDVRF

      570     580     590     600     610     620     630     640
NOV2  HTVVLRVATATDRDKDANGLVHYNIISGNSRGHFAIDSLTGEIQVAPLDFEAAREYALRIRAQDAGRPPLSNNTGLASIQ
Q9NYQ7 HTVVLRVATATDRDKDANGLVHYNIISGNSRGHFAIDSLTGEIQVAPLDFEAAREYALRIRAQDAGRPPLSNNTGLASIQ
Q91ZIO HTVVLRVATATDRDKDANGLVHYNIISGNSRGHFAIDSLTGEIQVAPLDFEAAREYALRIRAQDAGRPPLSNNTGLASIQ
O88278 HTVVLRVATATDRDKDANGLVHYNIISGNSRGHFAIDSLTGEIQVAPLDFEAAREYALRIRAQDAGRPPLSNNTGLASIQ
Q9HCU4 GAPVLRVTASDRDKGSAALVHYNIISGNSRGHFAIDSLTGEIQVAPLDFEAAREYALRIRAQDAGRPPLSNNTGLASIQ
Q9R0M0 GAPVLRVTASDRDKGSAALVHYNIISGNSRGHFAIDSLTGEIQVAPLDFEAAREYALRIRAQDAGRPPLSNNTGLASIQ

      650     660     670     680     690     700     710     720
NOV2  VVDINDH-IPFVSTPFPQSVLENAPLGHSVIHQAQVADADHGENARLEYSLTGVAPOTPPFVINSATGWVSVSGPLDRESV
Q9NYQ7 VVDINDH-IPFVSTPFPQSVLENAPLGHSVIHQAQVADADHGENARLEYSLTGVAPOTPPFVINSATGWVSVSGPLDRESV
Q91ZIO VVDINDH-APFVSTPFPQSVLENAPLGHSVIHQAQVADADHGENARLEYSLTGVAPOTPPFVINSATGWVSVSGPLDRESV
O88278 VVDINDH-SPFVSTPFPQSVLENAPLGHSVIHQAQVADADHGENARLEYSLTGVAPOTPPFVINSATGWVSVSGPLDRESV
Q9HCU4 VVDINDH-APFVSTPFPQSVLENAPLGHSVIHQAQVADADHGENARLEYSLTGVAPOTPPFVINSATGWVSVSGPLDRESV
Q9R0M0 VVDINDH-IPFVSTPFPQSVLENAPLGHSVIHQAQVADADHGENARLEYSLTGVAPOTPPFVINSATGWVSVSGPLDRESV

```

	730	740	750	760	770	780	790	800
NOV2	EHYFFGVEARDHGS	PPLSASASVT	TVLVDNDRP	EFTMKEYHLRL	NEDAAVGT	SVSVTA	VDRDANS	ISYQITGGNTR
Q9NYQ7	EHYFFGVEARDHGS	PPLSASASVT	TVLVDNDRP	EFTMKEYHLRL	NEDAAVGT	SVSVTA	VDRDANS	ISYQITGGNTR
Q91ZIO	EHYFFGVEARDHGS	PPLSASASVT	TVLVDNDRP	EFTMKEYHLRL	NEDAAVGT	SVSVTA	VDRDANS	ISYQITGGNTR
O88278	EHYFFGVEARDHGS	PPLSASASVT	TVLVDNDRP	EFTMKEYHLRL	NEDAAVGT	SVSVTA	VDRDANS	ISYQITGGNTR
Q9HCU4	EHYFFGVEARDHGS	PPLSASASVT	TVLVDNDRP	EFTMKEYHLRL	NEDAAVGT	SVSVTA	VDRDANS	ISYQITGGNTR
Q9ROM0	EHYFFGVEARDHGS	PPLSASASVT	TVLVDNDRP	EFTMKEYHLRL	NEDAAVGT	SVSVTA	VDRDANS	ISYQITGGNTR
	810	820	830	840	850	860	870	880
NOV2	NRFAISTCGG	GLVTLALPLD	YKQERYFK	LVTASDRAL	HDHCYVHINI	TDANTHRP	VPFQSAHYS	SVSNEDRPGSTHVV
Q9NYQ7	NRFAISTCGG	GLVTLALPLD	YKQERYFK	LVTASDRAL	HDHCYVHINI	TDANTHRP	VPFQSAHYS	SVSNEDRPGSTHVV
Q91ZIO	NRFAISTCGG	GLVTLALPLD	YKQERYFK	LVTASDRAL	HDHCYVHINI	TDANTHRP	VPFQSAHYS	SVSNEDRPGSTHVV
O88278	NRFAISTCGG	GLVTLALPLD	YKQERYFK	LVTASDRAL	HDHCYVHINI	TDANTHRP	VPFQSAHYS	SVSNEDRPGSTHVV
Q9HCU4	NRFAISTCGG	GLVTLALPLD	YKQERYFK	LVTASDRAL	HDHCYVHINI	TDANTHRP	VPFQSAHYS	SVSNEDRPGSTHVV
Q9ROM0	NRFAISTCGG	GLVTLALPLD	YKQERYFK	LVTASDRAL	HDHCYVHINI	TDANTHRP	VPFQSAHYS	SVSNEDRPGSTHVV
	890	900	910	920	930	940	950	960
NOV2	ISASDDVGENAR	ITYLLEDNLP	QFRIDADS	GATLQAPLD	YEDQVTTY	LAIATARD	NGIPQKAD	TTYVEVMVNDVNDNAF
Q9NYQ7	ISASDDVGENAR	ITYLLEDNLP	QFRIDADS	GATLQAPLD	YEDQVTTY	LAIATARD	NGIPQKAD	TTYVEVMVNDVNDNAF
Q91ZIO	ISASDDVGENAR	ITYLLEDNLP	QFRIDADS	GATLQAPLD	YEDQVTTY	LAIATARD	NGIPQKAD	TTYVEVMVNDVNDNAF
O88278	ISASDDVGENAR	ITYLLEDNLP	QFRIDADS	GATLQAPLD	YEDQVTTY	LAIATARD	NGIPQKAD	TTYVEVMVNDVNDNAF
Q9HCU4	ISASDDVGENAR	ITYLLEDNLP	QFRIDADS	GATLQAPLD	YEDQVTTY	LAIATARD	NGIPQKAD	TTYVEVMVNDVNDNAF
Q9ROM0	ISASDDVGENAR	ITYLLEDNLP	QFRIDADS	GATLQAPLD	YEDQVTTY	LAIATARD	NGIPQKAD	TTYVEVMVNDVNDNAF
	970	980	990	1000	1010	1020	1030	1040
NOV2	QFVASHYTGLV	SEDAPFFTS	VLQISATDR	DAHANGRV	QYTFQNG	EDGDDFT	IEPTSGIV	VRTVRLDREAVSVYELTAY
Q9NYQ7	QFVASHYTGLV	SEDAPFFTS	VLQISATDR	DAHANGRV	QYTFQNG	EDGDDFT	IEPTSGIV	VRTVRLDREAVSVYELTAY
Q91ZIO	QFVASHYTGLV	SEDAPFFTS	VLQISATDR	DAHANGRV	QYTFQNG	EDGDDFT	IEPTSGIV	VRTVRLDREAVSVYELTAY
O88278	QFVASHYTGLV	SEDAPFFTS	VLQISATDR	DAHANGRV	QYTFQNG	EDGDDFT	IEPTSGIV	VRTVRLDREAVSVYELTAY
Q9HCU4	QFVASHYTGLV	SEDAPFFTS	VLQISATDR	DAHANGRV	QYTFQNG	EDGDDFT	IEPTSGIV	VRTVRLDREAVSVYELTAY
Q9ROM0	QFVASHYTGLV	SEDAPFFTS	VLQISATDR	DAHANGRV	QYTFQNG	EDGDDFT	IEPTSGIV	VRTVRLDREAVSVYELTAY
	1050	1060	1070	1080	1090	1100	1110	1120
NOV2	VDKGVPPRL	TPVSIQVMQ	VDVNDNAP	VPFAEEF	FEVRVKENS	IVGSVVAQ	ITAVDP	DEGPNAHIMYQIVEGNIPELFCQMDI
Q9NYQ7	VDKGVPPRL	TPVSIQVMQ	VDVNDNAP	VPFAEEF	FEVRVKENS	IVGSVVAQ	ITAVDP	DEGPNAHIMYQIVEGNIPELFCQMDI
Q91ZIO	VDKGVPPRL	TPVSIQVMQ	VDVNDNAP	VPFAEEF	FEVRVKENS	IVGSVVAQ	ITAVDP	DEGPNAHIMYQIVEGNIPELFCQMDI
O88278	VDKGVPPRL	TPVSIQVMQ	VDVNDNAP	VPFAEEF	FEVRVKENS	IVGSVVAQ	ITAVDP	DEGPNAHIMYQIVEGNIPELFCQMDI
Q9HCU4	VDKGVPPRL	TPVSIQVMQ	VDVNDNAP	VPFAEEF	FEVRVKENS	IVGSVVAQ	ITAVDP	DEGPNAHIMYQIVEGNIPELFCQMDI
Q9ROM0	VDKGVPPRL	TPVSIQVMQ	VDVNDNAP	VPFAEEF	FEVRVKENS	IVGSVVAQ	ITAVDP	DEGPNAHIMYQIVEGNIPELFCQMDI
	1130	1140	1150	1160	1170	1180	1190	1200
NOV2	FSGELTALIDL	DYARQEVVI	VQATSAPL	VSRAIVH	RLVDQND	NSPVLNN	FOILFN	NYVSNRSDTFPSGIIIGRIIPAYC
Q9NYQ7	FSGELTALIDL	DYARQEVVI	VQATSAPL	VSRAIVH	RLVDQND	NSPVLNN	FOILFN	NYVSNRSDTFPSGIIIGRIIPAYC
Q91ZIO	FSGELTALIDL	DYARQEVVI	VQATSAPL	VSRAIVH	RLVDQND	NSPVLNN	FOILFN	NYVSNRSDTFPSGIIIGRIIPAYC
O88278	FSGELTALIDL	DYARQEVVI	VQATSAPL	VSRAIVH	RLVDQND	NSPVLNN	FOILFN	NYVSNRSDTFPSGIIIGRIIPAYC
Q9HCU4	FSGELTALIDL	DYARQEVVI	VQATSAPL	VSRAIVH	RLVDQND	NSPVLNN	FOILFN	NYVSNRSDTFPSGIIIGRIIPAYC
Q9ROM0	FSGELTALIDL	DYARQEVVI	VQATSAPL	VSRAIVH	RLVDQND	NSPVLNN	FOILFN	NYVSNRSDTFPSGIIIGRIIPAYC
	1210	1220	1230	1240	1250	1260	1270	1280
NOV2	PDVSDHLYF	SFERGNE	LQLLVNN	TSGELRLS	RKLDNNR	PLVASML	VTVDGL	HSVTAQCCLRUVIITEELLANSITVRL
Q9NYQ7	PDVSDHLYF	SFERGNE	LQLLVNN	TSGELRLS	RKLDNNR	PLVASML	VTVDGL	HSVTAQCCLRUVIITEELLANSITVRL
Q91ZIO	PDVSDHLYF	SFERGNE	LQLLVNN	TSGELRLS	RKLDNNR	PLVASML	VTVDGL	HSVTAQCCLRUVIITEELLANSITVRL
O88278	PDVSDHLYF	SFERGNE	LQLLVNN	TSGELRLS	RKLDNNR	PLVASML	VTVDGL	HSVTAQCCLRUVIITEELLANSITVRL
Q9HCU4	PDVSDHLYF	SFERGNE	LQLLVNN	TSGELRLS	RKLDNNR	PLVASML	VTVDGL	HSVTAQCCLRUVIITEELLANSITVRL
Q9ROM0	PDVSDHLYF	SFERGNE	LQLLVNN	TSGELRLS	RKLDNNR	PLVASML	VTVDGL	HSVTAQCCLRUVIITEELLANSITVRL
	1290	1300	1310	1320	1330	1340	1350	1360
NOV2	ENMWQERFL	SPLLGR	FLEGVA	AVLATP	EDVFIF	NIQNDT	DVGG	TVLNVSF
Q9NYQ7	ENMWQERFL	SPLLGR	FLEGVA	AVLATP	EDVFIF	NIQNDT	DVGG	TVLNVSF
Q91ZIO	ENMWQERFL	SPLLGR	FLEGVA	AVLATP	EDVFIF	NIQNDT	DVGG	TVLNVSF
O88278	ENMWQERFL	SPLLGR	FLEGVA	AVLATP	EDVFIF	NIQNDT	DVGG	TVLNVSF
Q9HCU4	ENMWQERFL	SPLLGR	FLEGVA	AVLATP	EDVFIF	NIQNDT	DVGG	TVLNVSF
Q9ROM0	ENMWQERFL	SPLLGR	FLEGVA	AVLATP	EDVFIF	NIQNDT	DVGG	TVLNVSF
	1370	1380	1390	1400	1410	1420	1430	1440
NOV2	RRALAARS	LLDVL	PFDDNV	CLREPC	ENYMK	CVSVLR	FDSSAP	FLASSTLFRPIQPIAGLRCRCPPGFTGDFCETELDL
Q9NYQ7	RRALAARS	LLDVL	PFDDNV	CLREPC	ENYMK	CVSVLR	FDSSAP	FLASSTLFRPIQPIAGLRCRCPPGFTGDFCETELDL
Q91ZIO	RRALAARS	LLDVL	PFDDNV	CLREPC	ENYMK	CVSVLR	FDSSAP	FLASSTLFRPIQPIAGLRCRCPPGFTGDFCETELDL
O88278	RRALAARS	LLDVL	PFDDNV	CLREPC	ENYMK	CVSVLR	FDSSAP	FLASSTLFRPIQPIAGLRCRCPPGFTGDFCETELDL
Q9HCU4	RRALAARS	LLDVL	PFDDNV	CLREPC	ENYMK	CVSVLR	FDSSAP	FLASSTLFRPIQPIAGLRCRCPPGFTGDFCETELDL
Q9ROM0	RRALAARS	LLDVL	PFDDNV	CLREPC	ENYMK	CVSVLR	FDSSAP	FLASSTLFRPIQPIAGLRCRCPPGFTGDFCETELDL
	1450	1460	1470	1480	1490	1500	1510	1520
NOV2	CYSNPCR	NGGACAR	REGGYTC	VCRCR	PRFTG	BCELD	TEAGRC	VPVCRNGGTCTAPNGGFRQCQCPAGGAFEGPRCEVAAR
Q9NYQ7	CYSNPCR	NGGACAR	REGGYTC	VCRCR	PRFTG	BCELD	TEAGRC	VPVCRNGGTCTAPNGGFRQCQCPAGGAFEGPRCEVAAR
Q91ZIO	CYSNPCR	NGGACAR	REGGYTC	VCRCR	PRFTG	BCELD	TEAGRC	VPVCRNGGTCTAPNGGFRQCQCPAGGAFEGPRCEVAAR
O88278	CYSNPCR	NGGACAR	REGGYTC	VCRCR	PRFTG	BCELD	TEAGRC	VPVCRNGGTCTAPNGGFRQCQCPAGGAFEGPRCEVAAR
Q9HCU4	CYSNPCR	NGGACAR	REGGYTC	VCRCR	PRFTG	BCELD	TEAGRC	VPVCRNGGTCTAPNGGFRQCQCPAGGAFEGPRCEVAAR
Q9ROM0	CYSNPCR	NGGACAR	REGGYTC	VCRCR	PRFTG	BCELD	TEAGRC	VPVCRNGGTCTAPNGGFRQCQCPAGGAFEGPRCEVAAR



Q9R0M0	CYSRTCGPHRCRCSREGGYTCRCGCTGCHCEASTHSGRCIPGVCRNGGTCVNLVGGIKDCDSC-HFEKRFCCVTTT
	1530 1540 1550 1560 1570 1580 1590 1600
NOV2	SFPSSFVMFRGLRQRFHLTSLSFATVQSSGLLFYNGRLNEKHDFLALVLVAGQVRLTYSTGESNTVVSPTVPGGLSDG
Q9NYQ7	SFPSSFVMFRGLRQRFHLTSLSFATVQSSGLLFYNGRLNEKHDFLALVLVAGQVRLTYSTGESNTVVSPTVPGGLSDG
Q91Z10	SFPSSFVMFRGLRQRFHLTSLSFATVQSSGLLFYNGRLNEKHDFLALVLVAGQVRLTYSTGESNTVVSPTVPGGLSDG
O88278	SFPSSFVMFRGLRQRFHLTSLSFATVQSSGLLFYNGRLNEKHDFLALVLVAGQVRLTYSTGESNTVVSPTVPGGLSDG
Q9HC04	SFPSSFVMFRGLRQRFHLTSLSFATVQSSGLLFYNGRLNEKHDFLALVLVAGQVRLTYSTGESNTVVSPTVPGGLSDG
Q9R0M0	SFPSSFVMFRGLRQRFHLTSLSFATVQSSGLLFYNGRLNEKHDFLALVLVAGQVRLTYSTGESNTVVSPTVPGGLSDG
	1610 1620 1630 1640 1650 1660 1670 1680
NOV2	QWHTVHLRYYNKPRTDALGGAQGPSKDKVAVLSVDDCDVAVALFGAEIGNYSCAAAGVQTSSKKSLDLTGPLLGGVFN
Q9NYQ7	QWHTVHLRYYNKPRTDALGGAQGPSKDKVAVLSVDDCDVAVALFGAEIGNYSCAAAGVQTSSKKSLDLTGPLLGGVFN
Q91Z10	QWHTVHLRYYNKPRTDALGGAQGPSKDKVAVLSVDDCDVAVALFGAEIGNYSCAAAGVQTSSKKSLDLTGPLLGGVFN
O88278	QWHTVHLRYYNKPRTDALGGAQGPSKDKVAVLSVDDCDVAVALFGAEIGNYSCAAAGVQTSSKKSLDLTGPLLGGVFN
Q9HC04	QWHTVHLRYYNKPRTDALGGAQGPSKDKVAVLSVDDCDVAVALFGAEIGNYSCAAAGVQTSSKKSLDLTGPLLGGVFN
Q9R0M0	QWHTVHLRYYNKPRTDALGGAQGPSKDKVAVLSVDDCDVAVALFGAEIGNYSCAAAGVQTSSKKSLDLTGPLLGGVFN
	1690 1700 1710 1720 1730 1740 1750 1760
NOV2	LPENFPVSHKDFIGCMRDLDHIDGRNMDMAAFVANNGTACGQAKHFCDSGPKCKNSFCSEKWSFSCDCPVGFGGKDC
Q9NYQ7	LPENFPVSHKDFIGCMRDLDHIDGRNMDMAAFVANNGTACGQAKHFCDSGPKCKNSFCSEKWSFSCDCPVGFGGKDC
Q91Z10	LPENFPVSHKDFIGCMRDLDHIDGRNMDMAAFVANNGTACGQAKHFCDSGPKCKNSFCSEKWSFSCDCPVGFGGKDC
O88278	LPENFPVSHKDFIGCMRDLDHIDGRNMDMAAFVANNGTACGQAKHFCDSGPKCKNSFCSEKWSFSCDCPVGFGGKDC
Q9HC04	LPENFPVSHKDFIGCMRDLDHIDGRNMDMAAFVANNGTACGQAKHFCDSGPKCKNSFCSEKWSFSCDCPVGFGGKDC
Q9R0M0	LPENFPVSHKDFIGCMRDLDHIDGRNMDMAAFVANNGTACGQAKHFCDSGPKCKNSFCSEKWSFSCDCPVGFGGKDC
	1770 1780 1790 1800 1810 1820 1830 1840
NOV2	LTMHFFHFRGNGTSLWDFGNDMAVSVPWYLGLEFRTRATCGVLMOVCGPHSTLLCOLDRGLLSVTITRSGRASHLL
Q9NYQ7	LTMHFFHFRGNGTSLWDFGNDMAVSVPWYLGLEFRTRATCGVLMOVCGPHSTLLCOLDRGLLSVTITRSGRASHLL
Q91Z10	LTMHFFHFRGNGTSLWDFGNDMAVSVPWYLGLEFRTRATCGVLMOVCGPHSTLLCOLDRGLLSVTITRSGRASHLL
O88278	LTMHFFHFRGNGTSLWDFGNDMAVSVPWYLGLEFRTRATCGVLMOVCGPHSTLLCOLDRGLLSVTITRSGRASHLL
Q9HC04	LTMHFFHFRGNGTSLWDFGNDMAVSVPWYLGLEFRTRATCGVLMOVCGPHSTLLCOLDRGLLSVTITRSGRASHLL
Q9R0M0	LTMHFFHFRGNGTSLWDFGNDMAVSVPWYLGLEFRTRATCGVLMOVCGPHSTLLCOLDRGLLSVTITRSGRASHLL
	1850 1860 1870 1880 1890 1900 1910 1920
NOV2	DOVTVSDGRWHDRLRLQLQEPGRRGHHFNVSLDFSLFQDTMAVSGELGKLVKQLHVGGPPGSAEAPGGLVGCIOG
Q9NYQ7	DOVTVSDGRWHDRLRLQLQEPGRRGHHFNVSLDFSLFQDTMAVSGELGKLVKQLHVGGPPGSAEAPGGLVGCIOG
Q91Z10	DOVTVSDGRWHDRLRLQLQEPGRRGHHFNVSLDFSLFQDTMAVSGELGKLVKQLHVGGPPGSAEAPGGLVGCIOG
O88278	DOVTVSDGRWHDRLRLQLQEPGRRGHHFNVSLDFSLFQDTMAVSGELGKLVKQLHVGGPPGSAEAPGGLVGCIOG
Q9HC04	DOVTVSDGRWHDRLRLQLQEPGRRGHHFNVSLDFSLFQDTMAVSGELGKLVKQLHVGGPPGSAEAPGGLVGCIOG
Q9R0M0	DOVTVSDGRWHDRLRLQLQEPGRRGHHFNVSLDFSLFQDTMAVSGELGKLVKQLHVGGPPGSAEAPGGLVGCIOG
	1930 1940 1950 1960 1970 1980 1990 2000
NOV2	VWEGSTFSSGSPALLPF-SHRVNAEPGCVVTNACASGCPCPHACDRLKOTFSCTCQPGYGGPGCVDACLLNCPQNGSCR
Q9NYQ7	VWEGSTFSSGSPALLPF-SHRVNAEPGCVVTNACASGCPCPHACDRLKOTFSCTCQPGYGGPGCVDACLLNCPQNGSCR
Q91Z10	VWEGSTFSSGSPALLPF-SHRVNAEPGCVVTNACASGCPCPHACDRLKOTFSCTCQPGYGGPGCVDACLLNCPQNGSCR
O88278	VWEGSTFSSGSPALLPF-SHRVNAEPGCVVTNACASGCPCPHACDRLKOTFSCTCQPGYGGPGCVDACLLNCPQNGSCR
Q9HC04	VWEGSTFSSGSPALLPF-SHRVNAEPGCVVTNACASGCPCPHACDRLKOTFSCTCQPGYGGPGCVDACLLNCPQNGSCR
Q9R0M0	VWEGSTFSSGSPALLPF-SHRVNAEPGCVVTNACASGCPCPHACDRLKOTFSCTCQPGYGGPGCVDACLLNCPQNGSCR
	2010 2020 2030 2040 2050 2060 2070 2080
NOV2	HLPGAPHGYTCDVCGYFGCHCEHRDQOCPRGWGSPTCGPNCDVHKGFDPNCNKTNGQCHCKEFHYRPRGSDSCLPC
Q9NYQ7	HLPGAPHGYTCDVCGYFGCHCEHRDQOCPRGWGSPTCGPNCDVHKGFDPNCNKTNGQCHCKEFHYRPRGSDSCLPC
Q91Z10	HLPGAPHGYTCDVCGYFGCHCEHRDQOCPRGWGSPTCGPNCDVHKGFDPNCNKTNGQCHCKEFHYRPRGSDSCLPC
O88278	HLPGAPHGYTCDVCGYFGCHCEHRDQOCPRGWGSPTCGPNCDVHKGFDPNCNKTNGQCHCKEFHYRPRGSDSCLPC
Q9HC04	HLPGAPHGYTCDVCGYFGCHCEHRDQOCPRGWGSPTCGPNCDVHKGFDPNCNKTNGQCHCKEFHYRPRGSDSCLPC
Q9R0M0	HLPGAPHGYTCDVCGYFGCHCEHRDQOCPRGWGSPTCGPNCDVHKGFDPNCNKTNGQCHCKEFHYRPRGSDSCLPC
	2090 2100 2110 2120 2130 2140 2150 2160
NOV2	DCYPVGSTSRSCAPHSGQCCPCRGALGRQCNSCDSPFAEVTASGCRVLYDACPKSLRSGVWVPQTKFGLATVPVPCRGAL
Q9NYQ7	DCYPVGSTSRSCAPHSGQCCPCRGALGRQCNSCDSPFAEVTASGCRVLYDACPKSLRSGVWVPQTKFGLATVPVPCRGAL
Q91Z10	DCYPVGSTSRSCAPHSGQCCPCRGALGRQCNSCDSPFAEVTASGCRVLYDACPKSLRSGVWVPQTKFGLATVPVPCRGAL
O88278	DCYPVGSTSRSCAPHSGQCCPCRGALGRQCNSCDSPFAEVTASGCRVLYDACPKSLRSGVWVPQTKFGLATVPVPCRGAL
Q9HC04	DCYPVGSTSRSCAPHSGQCCPCRGALGRQCNSCDSPFAEVTASGCRVLYDACPKSLRSGVWVPQTKFGLATVPVPCRGAL
Q9R0M0	DCYPVGSTSRSCAPHSGQCCPCRGALGRQCNSCDSPFAEVTASGCRVLYDACPKSLRSGVWVPQTKFGLATVPVPCRGAL
	2170 2180 2190 2200 2210 2220 2230 2240
NOV2	G-----AAVRLCDEAGWLEPDLFNCTSPAFRELSLLLDGLELNKLTALDTAEAKLAQRLREVTHGTHDYHFSQDVRVTAR
Q9NYQ7	G-----AAVRLCDEAGWLEPDLFNCTSPAFRELSLLLDGLELNKLTALDTAEAKLAQRLREVTHGTHDYHFSQDVRVTAR
Q91Z10	G-----AAVRLCDEAGWLEPDLFNCTSPAFRELSLLLDGLELNKLTALDTAEAKLAQRLREVTHGTHDYHFSQDVRVTAR
O88278	G-----AAVRLCDEAGWLEPDLFNCTSPAFRELSLLLDGLELNKLTALDTAEAKLAQRLREVTHGTHDYHFSQDVRVTAR
Q9HC04	G-----AAVRLCDEAGWLEPDLFNCTSPAFRELSLLLDGLELNKLTALDTAEAKLAQRLREVTHGTHDYHFSQDVRVTAR
Q9R0M0	G-----AAVRLCDEAGWLEPDLFNCTSPAFRELSLLLDGLELNKLTALDTAEAKLAQRLREVTHGTHDYHFSQDVRVTAR
	2250 2260 2270 2280 2290 2300 2310 2320
NOV2	LLAALLAFESHQCGGLTATQDAHFNENLLWAGSALLAPETGDLWAALQORAPGSGPSAGLVHLEEYAATLARNMBLT
Q9NYQ7	LLAALLAFESHQCGGLTATQDAHFNENLLWAGSALLAPETGDLWAALQORAPGSGPSAGLVHLEEYAATLARNMBLT
Q91Z10	LLAALLAFESHQCGGLTATQDAHFNENLLWAGSALLAPETGDLWAALQORAPGSGPSAGLVHLEEYAATLARNMBLT
O88278	LLAALLAFESHQCGGLTATQDAHFNENLLWAGSALLAPETGDLWAALQORAPGSGPSAGLVHLEEYAATLARNMBLT

Q9HC04 LATRLLAHESACRGFGLSATQDVHTENLLRVGSALIDTANKRHRELQCTEG---GAWLECYEAYASALANNRH  
Q9R0M0 LATRLLAHESACRGFGLSATQDVHTENLLRVGSALIDANKRHRELQCTEG---GAWLECYEAYASALANNRH

2330 2340 2350 2360 2370 2380 2390 2400

NOV2 YLNPLGLVTPNIMLSIDRMEHPSSPRGARRYPYHSNLFRCQDAWDPHTHVLLPSCSPRSPSPSEVLPTSSSIENSTSSV  
Q9NYQ7 YLNPLGLVTPNIMLSIDRMEHPSSPRGARRYPYHSNLFRCQDAWDPHTHVLLPSCSPRSPSPSEVLPTSSSIENSTSSV  
Q91Z10 YLNPLGLVTPNIMLSIDRMEHPSSPRGARRYPYHSNLFRCQDAWDPHTHVLLPSCSPRSPSPSEVLPTSSSIENSTSSV  
O88278 YLNPLGLVTPNIMLSIDRMEHPSSPRGARRYPYHSNLFRCQDAWDPHTHVLLPSCSPRSPSPSEVLPTSSSIENSTSSV  
Q9HC04 YLSPTHTVTPNIMLSVVRKK--GNFAGKLPREY--LRGRPPPEVEITVLEPESVFRMPSPMRSAGPGEAQETBELA  
Q9R0M0 YLSPTHTVTPNIMLSVVRKK--GNFAGKLPREY--LRGRPPPEVEITVLEPESVFRMPSPMRSAGPGEAQETBELA

2410 2420 2430 2440 2450 2460 2470 2480

NOV2 VPPAPPEPE--PGISITILLVYRTLGGLLPAQQAERRGARLPQNPMVNSPVVSVAVFGRNFRGLGLESPILEFRLL  
Q9NYQ7 VPPAPPEPE--PGISITILLVYRTLGGLLPAQQAERRGARLPQNPMVNSPVVSVAVFGRNFRGLGLESPILEFRLL  
Q91Z10 VSPPALEPESEPGISITILLVYRTLGGLLPAQQAERRGARLPQNPMVNSPVVSVAVFGRNFRGLGLESPILEFRLL  
O88278 VSPPALEPESEPGISITILLVYRTLGGLLPAQQAERRGARLPQNPMVNSPVVSVAVFGRNFRGLGLESPILEFRLL  
Q9HC04 RRQRRHPLS--QGEVASITHTLAGLLPHNDPPKSLRPPKRPVNSPVSFVHDDDELPRALDKMVPQFRLL  
Q9R0M0 RRQRRHPLS--QGEVASITHTLAGLLPHNDPPKSLRPPKRPVNSPVSFVHDDDELPRALDKMVPQFRLL

2490 2500 2510 2520 2530 2540 2550 2560

NOV2 QTANRSKALCVQWDPPLAQCCHQVWTARDCELVHRNGSHARCRCSTRGTGFGVMDASPRERLEGDELLAVFTHVVVAVS  
Q9NYQ7 QTANRSKALCVQWDPPLAQCCHQVWTARDCELVHRNGSHARCRCSTRGTGFGVMDASPRERLEGDELLAVFTHVVVAVS  
Q91Z10 QTANRSKALCVQWDPPLAQCCHQVWTARDCELVHRNGSHARCRCSTRGTGFGVMDASPRERLEGDELLAVFTHVVVAVS  
O88278 QTANRSKALCVQWDPPLAQCCHQVWTARDCELVHRNGSHARCRCSTRGTGFGVMDASPRERLEGDELLAVFTHVVVAVS  
Q9HC04 ETEERKPLCVFVNHSLVSGTGASAPGCEVFRNESHVSCCHMTSEAVLMEMVRRE--NDELPLKTLTVAAGVA  
Q9R0M0 ETEERKPLCVFVNHSLVSGTGASAPGCEVFRNESHVSCCHMTSEAVLMEMVRRE--NDELPLKTLTVAAGVA

2570 2580 2590 2600 2610 2620 2630 2640

NOV2 VVALVLTAAVLLSLRSLSKSNVRGIHANVAAALGVAELLFLLGIHRTHNQVQDQGGTCVLMITLLAQAWGQNSGS  
Q9NYQ7 VVALVLTAAVLLSLRSLSKSNVRGIHANVAAALGVAELLFLLGIHRTHNQVQDQGGTCVLMITLLAQAWGQNSGS  
Q91Z10 VVALVLTAAVLLSLRSLSKSNVRGIHANVAAALGVAELLFLLGIHRTHNQVQDQGGTCVLMITLLAQAWGQNSGS  
O88278 VVALVLTAAVLLSLRSLSKSNVRGIHANVAAALGVAELLFLLGIHRTHNQVQDQGGTCVLMITLLAQAWGQNSGS  
Q9HC04 VVALVLTFFFLTLRLTSSNOHGIRRNHTAALGVAELLFLLGIHRTADLP-----FACT  
Q9R0M0 VVALVLTFFFLTLRLTSSNOHGIRRNHTAALGVAELLFLLGIHRTADLP-----FACT

2650 2660 2670 2680 2690 2700 2710 2720

NOV2 AVAILLHYFFLSTFAWLTVQGLHLYRMQVEPRNVDRGAMRFYHALGNGVPAVLLGLAVGLDPEGYNPDFCWSVHEPLI  
Q9NYQ7 AVAILLHYFFLSTFAWLTVQGLHLYRMQVEPRNVDRGAMRFYHALGNGVPAVLLGLAVGLDPEGYNPDFCWSVHEPLI  
Q91Z10 AVAILLHYFFLSTFAWLTVQGLHLYRMQVEPRNVDRGAMRFYHALGNGVPAVLLGLAVGLDPEGYNPDFCWSVHEPLI  
O88278 AVAILLHYFFLSTFAWLTVQGLHLYRMQVEPRNVDRGAMRFYHALGNGVPAVLLGLAVGLDPEGYNPDFCWSVHEPLI  
Q9HC04 VVALVLTFFFLTLRLTSSNOHGIRRNHTAALGVAELLFLLGIHRTADLP-----FACT  
Q9R0M0 VVALVLTFFFLTLRLTSSNOHGIRRNHTAALGVAELLFLLGIHRTADLP-----FACT

2730 2740 2750 2760 2770 2780 2790 2800

NOV2 WSFAGPVVLVIVMNGTIFLLAARTSCSTGQREAKKTSALTLRSSFLLLLVSASWFGLLAVNHSILAFHYLHAGLCGL  
Q9NYQ7 WSFAGPVVLVIVMNGTIFLLAARTSCSTGQREAKKTSALTLRSSFLLLLVSASWFGLLAVNHSILAFHYLHAGLCGL  
Q91Z10 WSFAGPVVLVIVMNGTIFLLAARTSCSTGQREAKKTSALTLRSSFLLLLVSASWFGLLAVNHSILAFHYLHAGLCGL  
O88278 WSFAGPVVLVIVMNGTIFLLAARTSCSTGQREAKKTSALTLRSSFLLLLVSASWFGLLAVNHSILAFHYLHAGLCGL  
Q9HC04 WSFAGPVAFVAVSVFVFLAARASCAQCGFPAKGPVSGLRSSSTVLLLSASWLLALLVNSDTLPHYLPAACNC  
Q9R0M0 WSFAGPVAFVAVSVFVFLAARASCAQCGFPAKGPVSGLRSSSTVLLLSASWLLALLVNSDTLPHYLPAACNC

2810 2820 2830 2840 2850 2860 2870 2880

NOV2 CGLAVLLLCVNLADARAAMPAACLRKAAPPEARPAQGLPGAYNNTALFEESGLIRITLGASTVSSVSSARSGRQDQ  
Q9NYQ7 CGLAVLLLCVNLADARAAMPAACLRKAAPPEARPAQGLPGAYNNTALFEESGLIRITLGASTVSSVSSARSGRQDQ  
Q91Z10 CGLAVLLLCVNLADARAAMPAACLRKAAPPEARPAQGLPGAYNNTALFEESGLIRITLGASTVSSVSSARSGRQDQ  
O88278 CGLAVLLLCVNLADARAAMPAACLRKAAPPEARPAQGLPGAYNNTALFEESGLIRITLGASTVSSVSSARSGRQDQ  
Q9HC04 CGPFFIFSVVLSKSVKRLKFIACS-RKPSPPHPLTTKSTLSSVNCPPHAD-GRYQPYQDSAGLSHSRSCKQOP-  
Q9R0M0 CGPFFIFSVVLSKSVKRLKFIACS-RKPSPPHPLTTKSTLSSVNCPPHAD-GRYQPYQDSAGLSHSRSCKQOP-

2890 2900 2910 2920 2930 2940 2950 2960

NOV2 DSQGRSYLRDNVLRHGSMAETDHSLOAHAGPTDLLVAMFHRDAGADSDSDSLSEERSLSIPSSSEEDNGRTRGR  
Q9NYQ7 DSQGRSYLRDNVLRHGSMAETDHSLOAHAGPTDLLVAMFHRDAGADSDSDSLSEERSLSIPSSSEEDNGRTRGR  
Q91Z10 DSQGRSYLRDNVLRHGSMAETDHSLOAHAGPTDLLVAMFHRDAGADSDSDSLSEERSLSIPSSSEEDNGRTRGR  
O88278 DSQGRSYLRDNVLRHGSMAETDHSLOAHAGPTDLLVAMFHRDAGADSDSDSLSEERSLSIPSSSEEDNGRTRGR  
Q9HC04 -----SYEP--FLRE-ESALNPGQPPGLGDPGSLFLEGQDQHDPPDSDSDSLSEEDSGSYASHSSEEEEE  
Q9R0M0 -----SYEP--FLRE-ESTLNPQVPPGLGDPGSLFLEGQDQHDPPDSDSDSLSEEDSGSYASHSSEEEEE

2970 2980 2990 3000 3010 3020 3030 3040

NOV2 FORPLCAAQSERLLTHPKDVGNDLLSYWPALGCEAAPCALQNGSERRLGLDSKDAANNQPDPAITSGDBTSLGR  
Q9NYQ7 FORPLCAAQSERLLTHPKDVGNDLLSYWPALGCEAAPCALQNGSERRLGLDSKDAANNQPDPAITSGDBTSLGR  
Q91Z10 FORPLCAAQSERLLTHPKDVGNDLLSYWPALGCEAAPCALQNGSERRLGLDSKDAANNQPDPAITSGDBTSLGR  
O88278 FORPLCAAQSERLLTHPKDVGNDLLSYWPALGCEAAPCALQNGSERRLGLDSKDAANNQPDPAITSGDBTSLGR  
Q9HC04 EEE-----EAAFPGEQADS--LCPGCAELPLSTPKDGGPGCKAPWFC-  
Q9R0M0 EEE-----EAAFPGEQADS--LCPGCAELPLSTPKDGGPGCKAPWFC-

3050 3060 3070 3080 3090 3100 3110 3120

NOV2 AQQRKGILKNRLQYPLVPQTRCAPLSWCAATLGHRAVPAASYGRIYAGGGTGSLSQPASRYSSREQLDLLARQLS  
Q9NYQ7 AQQRKGILKNRLQYPLVPQTRCAPLSWCAATLGHRAVPAASYGRIYAGGGTGSLSQPASRYSSREQLDLLARQLS  
Q91Z10 AQQRKGILKNRLQYPLVPQTRCAPLSWCAATLGHRAVPAASYGRIYAGGGTGSLSQPASRYSSREQLDLLARQLS

O88278 AQRQRKGLKNRLOVPLVPOTRGTPELSWCRAATLGHRAVPAASYGRIYAGGGTSLSQPASRYSSREOLDLLRROLS  
 Q9HCU4 -----DFGTAK-----ESSNCAPET-----RLRNGDALSR-----  
 Q9R0M0 -----DFGTAK-----ENSSNCAPET-----RPRNGDALSR-----

3130 3140 3150 3160 3170 3180 3190 3200  
 NOV2 ERLEEA--PAPVIRPLSRPGSQECMDAPGRLEPKDRGSTLPRRQPPRDYPGMAGRFGRSDALDLGAPREWLSTLPPPF  
 Q9NYQ7 ERLEEA--PAPVIRPLSRPGSQECMDAPGRLEPKDRGSTLPRRQPPRDYPGMAGRFGRSDALDLGAPREWLSTLPPPF  
 Q91Z10 ERLEEVVVPAPVIRPLSRPGSQEBRTAPARLEARDRGSTLPRRQPPRDYPGMAGRFGRSDALDLGAPREWLSTLPPPF  
 O88278 ERLEEVVVPAPVIRPLSRPGSQEBRTAPARLEARDRGSTLPRRQPPRDYPGMAGRFGRSDALDLGAPREWLSTLPPPF  
 Q9HCU4 -----EGS-----LGLPGSSAPPHKGILKKKCLTISEKSLLRLELEQCTSSRG-----SSASEGSRGG-----PPPR  
 Q9R0M0 -----EGS-----LGLPGSSAPPHKGILKKKCLTISEKSLLRLELEQCTSSRG-----SSASEGSRHG-----PPPR

3210 3220 3230 3240 3250 3260 3270 3280  
 NOV2 RTRDLDPCPPPLPLSPQRQLSRDPLPSRPLDSLRSNSRREOLDQVPSRHPSREALGPPQLLRAREDSVSGPSHGSPST  
 Q9NYQ7 RTRDLDPCPPPLPLSPQRQLSRDPLPSRPLDSLRSNSRREOLDQVPSRHPSREALGPPQLLRAREDSVSGPSHGSPST  
 Q91Z10 RTRDLDPCPPPLPLSPQRQLSRDPLPSRPLDSLRSNSRREOLDQVPSRHPSREALGPPQLLRAREDSVSGPSHGSPST  
 O88278 RTRDLDPCPPPLPLSPQRQLSRDPLPSRPLDSLRSNSRREOLDQVPSRHPSREALGPPQLLRAREDSVSGPSHGSPST  
 Q9HCU4 -----PPPROSLCEQLN-----CVMPIANSIKAGNDEDSGSEF  
 Q9R0M0 -----PPPROSLCEQLN-----CVMPIANSIKAGNDEDSGSEF

3290 3300 3310 3320 3330 3340 3350 3360  
 NOV2 EQLDILSSILASFNSSALSSVQSSSTPLSPHTTATPSATASVLGPSTPRSATSHSISELSPDSEPRDQALLSATQAMDL  
 Q9NYQ7 EQLDILSSILASFNSSALSSVQSSSTPLSPHTTATPSATASVLGPSTPRSATSHSISELSPDSE-----VPR  
 Q91Z10 EQLDILSSILASFNSSALSSVQSSSTPLSPHTTAT-----ASALGPSTPRSATSHSISELSPDSE-----VPR  
 O88278 EQLDILSSILASFNSSALSSVQSSSTPLSPHTTATPSATASALGPSTPRSATSHSISELSPDSE-----VPR  
 Q9HCU4 LFFNFTH-----  
 Q9R0M0 LFFNFTH-----

3370 3380 3390 3400 3410 3420 3430 3440  
 NOV2 RRRDYHMERPLLNQEHLEELGRWGSAPTHQWRTWLQCSRARAYALLQHLFVLVWLPYFVRDWLLGLSGLSVAIMQ  
 Q9NYQ7 SEGHS-----  
 Q91Z10 SEGHS-----  
 O88278 SEGHS-----  
 Q9HCU4 -----  
 Q9R0M0 -----

3450 3460 3470 3480 3490 3500 3510 3520  
 NOV2 LPQGLAYALLAGLPPVFLGYSSFPVFYFLFGTSRHISVESLCPGVPDVTGTFAVMSVMVGSVTESLAPQALNDSMINE  
 Q9NYQ7 -----  
 Q91Z10 -----  
 O88278 -----  
 Q9HCU4 -----  
 Q9R0M0 -----

3530 3540 3550 3560 3570 3580 3590 3600  
 NOV2 TARDARVQVASTLSVLVGLFQVGLGLIHFGFVVTYLSLSEPLVRGYTTAAAVQVFVSQKLYVFLGLHSSHGFLSLIYTVL  
 Q9NYQ7 -----  
 Q91Z10 -----  
 O88278 -----  
 Q9HCU4 -----  
 Q9R0M0 -----

3610 3620 3630 3640 3650 3660 3670 3680  
 NOV2 EVCWKLQSKVGTVTVTAAGVGVVLVVKLLNDKLLQQLPMPPIGELLTLIGATGISYGMGLKHRFEVDVVGNI PAGLVPP  
 Q9NYQ7 -----  
 Q91Z10 -----  
 O88278 -----  
 Q9HCU4 -----  
 Q9R0M0 -----

3690 3700 3710 3720 3730 3740 3750 3760  
 NOV2 VAPNTQLFSKLVGSAFTIAVVGFAIAISLGIKIFALRHGYRVDSNQELVALGLSNLIGGIFQCFPVVSCMSRSLVQESTGG  
 Q9NYQ7 -----  
 Q91Z10 -----  
 O88278 -----  
 Q9HCU4 -----  
 Q9R0M0 -----

3770 3780 3790 3800 3810 3820 3830 3840  
 NOV2 NSQVAGAISSLFILLIIVKLGELFHDLPKAVLAATIIIVNLKGMRLQLSDMRSLWKNRADLLIWLVTFTATILLNLDLGL  
 Q9NYQ7 -----  
 Q91Z10 -----  
 O88278 -----  
 Q9HCU4 -----  
 Q9R0M0 -----

3850 3860 3870 3880 3890 3900 3910 3920  
 NOV2 VVAVIFSLLLIVVVRTQMPHYSVLGQVPDTDIYRDVAEYSEAKEVRGVKVFRRSSATVYFANAFYSDALKQRCGVVDVDFLI  
 Q9NYQ7 -----

Q91ZIO	-----
O88278	-----
Q9HCU4	-----
Q9ROM0	-----
	3930 3940 3950 3960 3970 3980 3990 4000
NOV2	..... ..... ..... ..... ..... ..... ..... .....
Q9NYQ7	SQKKKLLKKQEQLKQLQKEEKLKQAGPLLSACLAPQVSSGDKMEDATANGQEDSKAPDGLKALGLPQPDFHSLI
Q91ZIO	-----
O88278	-----
Q9HCU4	-----
Q9ROM0	-----
	4010 4020 4030 4040 4050 4060 4070 4080
NOV2	..... ..... ..... ..... ..... ..... ..... .....
Q9NYQ7	LDLGALSFVDTVCLKSLKNIFHDFREIEVEVYMAACHSPVVSQLEAGHFFDASITKKHLFASVHDAVTFALQHPRPVPDS
Q91ZIO	-----
O88278	-----
Q9HCU4	-----
Q9ROM0	-----
	4090 4100 4110 4120
NOV2	..... ..... ..... .....
Q9NYQ7	PVSPSLAVSSDVKQLEPELLLRNLLSGIPEKVQGSVGGANGQSLEDTE
Q91ZIO	-----
O88278	-----
Q9HCU4	-----
Q9ROM0	-----

BLAST analysis was performed on sequences from the Patp database, which is a proprietary database that contains sequences published in patents and patent publications. Patp results include those listed in Table 2E.

5

Table 2E. Patp BLASTP Analysis for NOV2					
Sequences producing High-scoring Segment Pairs	Protein/ Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAE03657	Human extracellular matrix and cell adhesion molecule-21 (XMAD-21) - Homo sapiens	3298	2421/2618 (92%)	2450/2618 (93%)	0.0
patp:AAU07054	Human Flamingo protein encoded by cDNA splice variant - Homo sapiens	2923	1345/2330 (57%)	1681/2330 (72%)	0.0
patp:AAU07053	Human Flamingo polypeptide - Homo sapiens	2956	1345/2330 (57%)	1681/2330 (72%)	0.0
patp:AAE08586	Human NOV7 protein - Homo sapiens	3028	1192/2237 (53%)	1551/2237 (69%)	0.0
patp:AAB42192	Human ORFX ORF1956 polypeptide sequence SEQ ID NO:3912 - Homo sapiens	2405	1046/1687 (62%)	1284/1687 (76%)	0.0

Table 2F lists the domain description from DOMAIN analysis results against NOV2.

Table 2F. Domain Analysis of NOV2						
Model	Domain	seq-f	seq-t	hmm-f	hmm-t	score E-value

Protein	Seq ID	Start	End	Score	E-value
cadherin	1/9	329	423	89.9	5e-23
cadherin	2/9	437	535	94.9	1.6e-24
cadherin	3/9	549	641	107.4	2.7e-28
cadherin	4/9	655	746	103.9	3.2e-27
cadherin	5/9	760	848	76.9	4.3e-19
cadherin	6/9	862	951	80.0	4.7e-20
cadherin	7/9	965	1057	99.7	5.8e-26
cadherin	8/9	1071	1159	87.4	2.8e-22
EGF	2/6	1438	1469	33.3	5.6e-06
EGF	3/6	1478	1512	35.8	9.8e-07
laminin_G	1/3	1542	1606	56.1	8.2e-15
EGF	4/6	1725	1756	40.4	4.1e-08
laminin_G	3/3	1792	1926	30.4	1.9e-07
EGF	5/6	1949	1980	33.1	6.4e-06
EGF	6/6	1984	2018	35.2	1.5e-06
HRM	1/1	2125	2182	75.6	1.1e-18
GPS	1/1	2475	2528	85.7	9.4e-22
7tm_2	1/1	2535	2805	320.5	2e-92
Sulfate_transp	1/1	3532	3842	363.5	2.3e-105
STAS	1/1	3865	4053	61.3	2e-14

# Alignments of top-scoring domains:

cadherin: domain 1 of 9, from 329 to 423: score 89.9, E = 5e-23

```
(SEQ ID NO:72)  ysasvpEnapvGtevlvtAtDaDdplgpNgrirYsilggnp...gg
                |+  |||++  ||  ||+  |+|+  |  ||++||+  +++
NOV2      329  YQTLVPENEAAGTAVLRVVAQDPD--AGEAGRLVYSLAALMNsrsLE 373

                wFrIdpdtGdnegiisttkpLDREeifngeYeLtveAtDadplsaaaggsp
                |+|||++  ||  ||++  |||++  +++  |  |+|+  |||
374  LFSIDPQSGL----IRTAALDRESM--ERHYLRVTAQDH-----GSP 410

                plsgtatvtitVl<-*
                ||+||++  +||
411  RLSATTMVAVTVA      423
```

cadherin: domain 2 of 9, from 437 to 535: score 94.9, E = 1.6e-24

```
(SEQ ID NO:73)  ysasvpEnapvGtevlvtAtDaDdplgpNgrirYsilggnp....
                |  +++||+  |  ++|+++||  |  +||+++|+++|++  +
NOV2      437  YRETLENVEEGYPILQLRATDGD--APPNANLRYRFVGPPAaaaa 481

                ggwFrIdpdtGdnegiisttkpLDREeifngeYeLtveAtDadplsaaagg
                +  |+|||++  ||  ++|||++  ++|||+|||+|+++
482  AAAFEIDPRSGL----ISTSGRVDREHM--ESYELVVEASDQGQ-----E 520

                spplsgtatvtitVl<-*
                +  |+|+||+|||
521  GPRSATVRVHITVL      535
```

cadherin: domain 3 of 9, from 549 to 641: score 107.4, E = 2.7e-28

```
(SEQ ID NO:74)  ysasvpEnapvGtevlvtAtDaDdplgpNgrirYsilggnpggwFr
                |+|+|+|++++  |  ||+|||+|  +||  ++  ||+||++|++
NOV2      549  YVAQVREDVRPHTVVLRVATDRD--KDANGLVHYNIIISGNSRGHFA 593

                IdpdtGdnegiisttkpLDREeifngeYeLtveAtDadplsaaaggsppls
                ||+  ||+  |  +++||  |  +||  |  ++|+||  |||
594  IDSLTGE----IQVVAPLDFEAE--REYALRIRAQDA-----GRPPLS 630

                .gtatvtitVl<-*
                ++|+  |+
631  nNTGLASIQVV      641
```

cadherin: domain 4 of 9, from 655 to 746: score 103.9, E = 3.2e-27

```
(SEQ ID NO:75)  ysasvpEnapvGtevlvtAtDaDdplgpNgrirYsilggnpggwFr
                +++||  |||  |  +|++++|+||  +|  |+|  ||++  |  +
NOV2      655  FQVSVLENAPLGHSVIHQAVDAD--HGENARLEYSLTGVPDTPFV 699

                IdpdtGdnegiisttkpLDREeifngeYeLtveAtDadplsaaaggsppls
                |+++|+  +|+  |||+  +  +  |  +||+|+  |||
```

26







lykelkkrGvelvLvgpspevrrtleltGlddligke.kifptvaeA<-* +++++ +   ++++ ++     ++++  + +++ ++ ++  4007 IFHDFREIEVEVYMAACHSPVVSQLEAGHFFDASITKkHLFASVHDA 4053
---

The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies. For example, the compositions of the present invention will have efficacy for treatment of patients such as Mucopolysaccharidosis type IX; Colorectal cancer, hereditary nonpolyposis, type 2; Turcotsyndrome with glioblastoma, 276300; Muir-Torre family cancer syndrome, 158320; Neurofibromatosis type 1 and leukemia; Hemolytic anemia due to glutathione peroxidase deficiency; Epidermolysis bullosa dystrophica, dominant, 131750; Epidermolysis bullosa dystrophica, recessive, 226600; Epidermolysis bullosa, pretibial, 131850; Metaphyseal chondrodysplasia, Murk Jansen type, 156400; Colorectal cancer; Hepatoblastoma; Pilomatricoma; Ovarian carcinoma, endometrioid type.

The protein similarity information for the invention(s) suggest that this gene may function as MEGF, Flamingo or cadherin family genes in the tissues in which it is expressed and in the pathologies in which it has been implicated (Tissue expression and disease association section). Therefore, the nucleic acids and proteins of the invention are useful in potential therapeutic applications implicated in various pathologies/disorders described previously and/or other pathologies/disorders associated with the tissues in which it is expressed, as well as disorders that MEGF, Flamingo and cadherin family members have been implicated. This gene is expressed in the following tissues: Thalamus, Fetal Brain. Since this protein's transcript was found in brain tissue, the gene encoding for it may be implicated in the following (but not limited to) neurodegenerative disorders: Dementia, Amyotrophic Lateral Sclerosis, Alzheimer Disease, Dystonia, Optic Atrophy and Huntington Disease. Additional disease indications and tissue expression for NOV2 and NOV2 variants, if available, are presented in the Examples.

Screening exploits 5'-end single-pass sequence data obtained from a pool of cDNAs whose sizes exceed 5 kb. Using this screening procedure, five known and nine new genes for proteins with multiple EGF-like-motifs from 8000 redundant human brain cDNA clones were identified. These new genes were found to encode a novel mammalian homologue of Drosophila fat protein, two seven-transmembrane proteins containing multiple cadherin and EGF-like motifs, two mammalian homologues of Drosophila slit protein, an unidentified LDL receptor-like protein, and three totally uncharacterized proteins. The organization of the domains in the proteins, together with their expression profiles and fine chromosomal

locations, has indicated their biological significance, demonstrating that motif-trap screening is a powerful tool for the discovery of new genes that have been difficult to identify by conventional methods. Genomics 1998 Jul 1;51(1):27-34 PMID: 9693030, UI: 98360089

5 Flamingo, a seven-pass transmembrane cadherin, regulates planar cell polarity under the control of Frizzled. A seven-pass transmembrane receptor of the cadherin superfamily, designated Flamingo (Fmi), localized to cell-cell boundaries in the Drosophila wing. In the absence of Fmi, planar polarity was distorted. Before morphological polarization of wing cells along the proximal-distal (P-D) axis, Fmi was redistributed predominantly to proximal and distal cell edges. This biased localization of Fmi appears to be driven by an imbalance of the  
10 activity of Frizzled (Fz) across the proximal/distal cell boundary. These results, together with phenotypes caused by ectopic expression of fz and fmi, suggest that cells acquire the P-D polarity by way of the Fz-dependent boundary localization of Fmi. Cell 1999 Sep 3;98(5):585-95 PMID: 10490098, UI: 99418630

The various functions of MEGF, Flamingo and cadherin family members include, but are  
15 not limited to cell to cell adhesion, cell to matrix adhesion, receptor-ligand interactions, immunological functions, vaso-permeability, cell recognition, tissue morphogenesis, cell proliferation, invasion and metastasis of malignant tumors.

Cell-cell and cell-matrix interactions that involve adhesion molecules like cadherins are important in many developmental processes. Cadherins mediate homophilic, calcium-  
20 dependent cell-cell adhesion in a wide variety of tissues and are important regulators of morphogenesis, and loss of function may be involved in the invasion and metastasis of malignant tumors. (OMIM ID600976)

### NOV3

A disclosed NOV3 nucleic acid (SEQ ID NO:5) of 1438 nucleotides (also referred to  
25 as CG55806-01) encoding a novel Coagulation Factor IX Precursor-like protein is shown in Table 3A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 2-4 and ending with a TAA codon at nucleotides 1184-1186. Putative untranslated regions are found upstream from the initiation codon and downstream from the termination codon, and are underlined. The start and stop codons are shown in bold letters in  
30 Table 3A.

Table 3A. NOV3 nucleotide sequence (SEQ ID NO:5).
<u>TATG</u> CAGCGTGAACATGATCATGGCAGAATCACCAGGCCTCATCACCATCTGCCTTTTAGGA TATCTACTCAGTGCTGAATGTACAGTTTTTCTTGATCATGAAAACGCCAACAAAATTCTGAATC GGCCAAAGAGGTATAATTGAGTAAATTGGAAGAGTTTGTTCAAGGGAACCTTGAGAGAGAATG TCTGGAGGAAAAGTGTAGTTTTGAAGAAGCACGAGAAGTTTTGAAACACTGAAAGAACAAC

GAATTTTGAAGCAGTATGTTGATGGAGATCAGTGTGAGTCCAATCCATGTTTAAATGGCGGCA  
 GTTGCAAGGATGACATTAATTCCTATGAATGTTGGTGTCCCTTTGGATTTGAAGGAAAGAACTG  
 TGAATTAGATGTGGACTATGTAAATCTACTGAAGCTGAAACCATTTTGGATAACATCACTCAA  
 AGCACCCAATCATTTAATGACTTCACTCGGGTGTGTTGGTGGAGAAGATGCCAAACCAGGTCAAT  
 TCCCTTGGCAGGTTGTTTGAATGGTAAAGTTGATGCATTCTGTGGAGGCTCTATCGTTAATGA  
 AAAATGGATTGTAAGTCTGCTGCCCCTGTGTTGAAACTGGTGTAAAATTACAGTTGTCGCAGGT  
 GAACATAATATTGAGGAGACAGAACATACAGAGCAAAAGCGAAATGTGATTGCAATTATTCCTC  
 ACCACAACATACAATGCAGCTATTAATAAGTACAACCATGACATTGCCCTTCTGGAACCTGGACGA  
 ACCCTTAGTGCTAAACAGCTACGTTACACCTATTTGCATTGCTGACAAGGAATACACGAACATC  
 TTCCTCAAATTTGGATCTGGCTATGTAAGTGGCTGGGGAAGAGTCTCCACAAAGGGAGATCAG  
 CTTTAGTTCTTTCAGTACCTTAGAGTTCCACTTGTGACCGAGCCACATGTCTTCGATCTACAAA  
 GTTCAACCATCTATAACAACATGTTCTGTGCTGGCTTCCATGAAGGAGGTAGAGATTCTGTCAA  
 GGAGATAGTGGGGGACCCCATGTTACTGAAGTGAAGGGACCAGTTTCTTAAGTGAATATTATTA  
 GCTGGGGTGAAGAGTGTGCAATGAAAGGCAAATATGGAATATATACCAAGGTATCCCGGTATGT  
 CAACTGGATTAAGGAAAAACAAAGCTCACTTAATGAAAGATGGATTCCAAGGTTAATTCATT  
 GGAATTGAAAATTAACAGGGCCTCTCACTAACTAATCACTTTCCCATCTTTTGTTAGATTGAA  
 TATATACATTCTATGATCATTTCTTTTCTCTTTACAGGGGAGAATTCATATTTTACCTGAGC  
 AAATTGATTAGAAAATGGAACCACTAGAGGAATATAATGTGTTAGGAAATTACAGTCATTTCTA  
 AGGGCCCAGCCTTGACAAATTGTGAGTAA

The NOV3 disclosed in this invention maps to chromosome X.

In a search of sequence databases, it was found, for example, that the nucleic acid  
 sequence of this invention has 1047 of 1047 bases (100%) identical to a gb:GENBANK-  
 ID:A13997|acc:A13997.1 mRNA from Homo sapiens (H.sapiens mRNA for factor IX).

A disclosed NOV3 polypeptide (SEQ ID NO:6) encoded by SEQ ID NO:5 has 394  
 amino acid residues and is presented in Table 3B using the one-letter amino acid code.  
 SignalP, Psort and/or Hydropathy results predict that NOV3 The results predict that this  
 sequence is likely to be localized extracellularly with a certainty of 0.5947. In an alternative  
 embodiment, NOV3 is likely to be localized to the lysosome (lumen) with a certainty of  
 0.1900, or to the endoplasmic reticulum (membrane) with a certainty of 0.1000, or to the  
 endoplasmic reticulum (lumen) with a certainty 0.1000. The most likely cleavage site for a  
 NOV3 peptide is between amino acids 25 and 26, *i.e.*, at the dash between amino acids LLS-  
 AE.

**Table 3B. Encoded NOV3 protein sequence (SEQ ID NO:6).**

MQRVNMIMAESPLITICLLGYLLSAECTVFLDHENANKILNRPKRYNSGKLEEFVQGNLEREC  
 LEEKCSFEEAREVFENTERTTEFWKQYVDGDQCESNPCLNGGSKDDINSYECWCPFGFEGKNC  
 ELDVDYVNSTEAETILDNITQSTQSFNDFTRVVGGEDAKPGQFPWQVVLNGKVDAFCGGSIVNE  
 KWIIVTAAHCVETGVKITVVAGEHNIETEHTEQKRNVIRIIPHHNYNAAINKYNHDIALLELDE  
 PLVLNSYVTPICIDKEYTNIIFLKFGSGYVSGWGRVPHKGRSALVLQYLRVPLVDRATCLRSTK  
 FTIYNNMFCAGFHEGGRDSCQDSSGGPHVTEVEGTSFLTGIISWGEECAMKGKYGIYTKVSRVY  
 NWIKEKTKLT

The full amino acid sequence of the protein of the invention was found to have 264 of  
 264 amino acid residues (100%) identical to, and 264 of 264 amino acid residues (100%)  
 similar to, the 461 amino acid residue ptnr:SWISSPROT-ACC:P00740 protein from Homo

sapiens (Human) (COAGULATION FACTOR IX PRECURSOR (EC 3.4.21.22) (CHRISTMAS FACTOR)).

In a further search of public sequence databases, NOV3 was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 3C.

**Table 3C. BLASTP results for NOV3**

Gene Index/ Identifier	Protein/ Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SWISSPROT- ACC:P00740	Coagulation factor IX precursor (EC 3.4.21.22) (Christmas factor) - Homo sapiens	461	264/264 (100%)	264/264 (100%)	2.0e-219
ptnr:REMTREMBL- ACC:CAA00205	FACTOR IX - Homo sapiens	461	264/264 (100%)	264/264 (100%)	2.0e-219
ptnr:SPTREMBL- ACC:Q95ND7	COAGULATION FACTOR XI - Pan troglodytes	461	263/264 (99%)	264/264 (100%)	4.2e-219
ptnr:SPTREMBL- ACC:Q14316	F9 (COAGULATION FACTOR IX (PLASMA THROMBOPLASTIC COMPONENT, CHRISTMAS DISEASE, HAEMOPHILIA B)) (FACTOR IX) - Homo sapiens	456	264/264 (100%)	264/264 (100%)	8.9e-217
ptnr:REMTREMBL- ACC:CAA01607	FACTOR IX PROTEIN - Homo sapiens	456	262/264 (99%)	262/264 (99%)	1.7e-215

The homology of these sequences is shown graphically in the ClustalW analysis shown in Table 3D. The NOV3 polypeptide is provided in lane 1.

**Table 3D. ClustalW Analysis of NOV3**

1) NOV3 (SEQ ID NO:6)	
2) P00740 (SEQ ID NO:92)	
3) CAA00205 (SEQ ID NO:93)	
4) Q95ND7 (SEQ ID NO:94)	
5) Q14316 (SEQ ID NO:95)	
6) CAA01607 (SEQ ID NO:96)	
	10 20 30 40 50 60 70 80
NOV3	MQRVNMIMAESPLGITICLLGYLLSAECTVFLDHENANKILNRPKRYNSGKLEEFVQGNLERECMEKCSFEEAREVFEN
P00740	MQRVNMIMAESPLGITICLLGYLLSAECTVFLDHENANKILNRPKRYNSGKLEEFVQGNLERECMEKCSFEEAREVFEN
CAA00205	MQRVNMIMAESPLGITICLLGYLLSAECTVFLDHENANKILNRPKRYNSGKLEEFVQGNLERECMEKCSFEEAREVFEN
Q95ND7	MQRVNMIMAESPLGITICLLGYLLSAECTVFLDHENANKILNRPKRYNSGKLEEFVQGNLERECMEKCSFEEAREVFEN
Q14316	-----MIMAESPLGITICLLGYLLSAECTVFLDHENANKILNRPKRYNSGKLEEFVQGNLERECMEKCSFEEAREVFEN
CAA01607	-----MIMAESPLGITICLLGYLLSAECTVFLDHENANKILNRPKRYNSGKLEEFVQGNLERECMEKCSFEEAREVFEN
	90 100 110 120 130 140 150 160
NOV3	TERTTEFWKQYVDGQCESNPCLNGGSKDDINSYECWCPFGFEGKNCELDVTGNIKNGRCEQFCCKNSADNKVVCSTEG
P00740	TERTTEFWKQYVDGQCESNPCLNGGSKDDINSYECWCPFGFEGKNCELDVTGNIKNGRCEQFCCKNSADNKVVCSTEG
CAA00205	TERTTEFWKQYVDGQCESNPCLNGGSKDDINSYECWCPFGFEGKNCELDVTGNIKNGRCEQFCCKNSADNKVVCSTEG
Q95ND7	TERTTEFWKQYVDGQCESNPCLNGGSKDDINSYECWCPFGFEGKNCELDVTGNIKNGRCEQFCCKNSADNKVVCSTEG
Q14316	TERTTEFWKQYVDGQCESNPCLNGGSKDDINSYECWCPFGFEGKNCELDVTGNIKNGRCEQFCCKNSADNKVVCSTEG
CAA01607	TERTTEFWKQYVDGQCESNPCLNGGSKDDINSYECWCPFGFEGKNCELDVTGNIKNGRCEQFCCKNSADNKVVCSTEG
	170 180 190 200 210 220 230 240
NOV3	-----DYVNSTEABTILDNITQSTQSFNDFTRVVGGEDAKPGQFPW
P00740	YRLAENQKSCEPAVFPFCGRVSVSQTSLTRAETVFPDQVYVNSTEABTILDNITQSTQSFNDFTRVVGGEDAKPGQFPW
CAA00205	YRLAENQKSCEPAVFPFCGRVSVSQTSLTRAETVFPDQVYVNSTEABTILDNITQSTQSFNDFTRVVGGEDAKPGQFPW
Q95ND7	YRLAENQKSCEPAVFPFCGRVSVSQTSLTRAETVFPDQVYVNSTEABTILDNITQSTQSFNDFTRVVGGEDAKPGQFPW
Q14316	YRLAENQKSCEPAVFPFCGRVSVSQTSLTRAETVFPDQVYVNSTEABTILDNITQSTQSFNDFTRVVGGEDAKPGQFPW
CAA01607	YRLAENQKSCEPAVFPFCGRVSVSQTSLTRAETVFPDQVYVNSTEABTILDNITQSTQSFNDFTRVVGGEDAKPGQFPW
	250 260 270 280 290 300 310 320
NOV3	QVVLNGKVDAFCGGSIVNEKWIIVTAACHCVETGVKITVAVAGEHNIETEHTEQKRNIVIRIIPHNNYNAATINKYNHDIALL
P00740	QVVLNGKVDAFCGGSIVNEKWIIVTAACHCVETGVKITVAVAGEHNIETEHTEQKRNIVIRIIPHNNYNAATINKYNHDIALL

CAA00205	QVVLNGKVDAPCGGSIVNEKWIWTAACHVETGVKITVVAEHNIEETEHTEQKRNVRIRIIPHNNYNAAINKYNHDIALLE
Q95ND7	QVVLNGKVDAPCGGSIVNEKWIWTAACHVETGVKITVVAEHNIEETEHTEQKRNVRIRIIPHNNYNAAINKYNHDIALLE
Q14316	QVVLNGKVDAPCGGSIVNEKWIWTAACHVETGVKITVVAEHNIEETEHTEQKRNVRIRIIPHNNYNAAINKYNHDIALLE
CAA01607	QVVLNGKVDAPCGGSIVNEKWIWTAACHVETGVKITVVAEHNIEETEHTEQKRNVRIRIIPHNNYNAAINKYNHDIALLE

330340350360370380390400

NOV3LDEPLVLNSYVTPICIAADKEYTNIFLKFGSGYVSGWGRVFKGRSALVLQYLRVPLVDRATCLRSTKFTIYNNMFCAGFH

P00740LDEPLVLNSYVTPICIAADKEYTNIFLKFGSGYVSGWGRVFKGRSALVLQYLRVPLVDRATCLRSTKFTIYNNMFCAGFH

CAA00205LDEPLVLNSYVTPICIAADKEYTNIFLKFGSGYVSGWGRVFKGRSALVLQYLRVPLVDRATCLRSTKFTIYNNMFCAGFH

Q95ND7LDEPLVLNSYVTPICIAADKEYTNIFLKFGSGYVSGWGRVFKGRSALVLQYLRVPLVDRATCLRSTKFTIYNNMFCAGFH

Q14316LDEPLVLNSYVTPICIAADKEYTNIFLKFGSGYVSGWGRVFKGRSALVLQYLRVPLVDRATCLRSTKFTIYNNMFCAGFH

CAA01607LDEPLVLNSYVTPICIAADKEYTNIFLKFGSGYVSGWGRVFKGRSALVLQYLRVPLVDRATCLRSTKFTIYNNMFCAGFH

	410	420	430	440	450	460
NOV3	EGGRDSCQGDSCGGPHVTEVEGTSFLTGLIISWGEBCAMKKGKGIYTKVSRVYNNWIKETKLT					
P00740	EGGRDSCQGDSCGGPHVTEVEGTSFLTGLIISWGEBCAMKKGKGIYTKVSRVYNNWIKETKLT					
CAA00205	EGGRDSCQGDSCGGPHVTEVEGTSFLTGLIISWGEBCAMKKGKGIYTKVSRVYNNWIKETKLT					
Q95ND7	EGGRDSCQGDSCGGPHVTEVEGTSFLTGLIISWGEBCAMKKGKGIYTKVSRVYNNWIKETKLT					
Q14316	EGGRDSCQGDSCGGPHVTEVEGTSFLTGLIISWGEBCAMKKGKGIYTKVSRVYNNWIKETKLT					
CAA01607	EGGRDSCQGDSCGGPHVTEVEGTSFLTGLIISWGEBCAMKKGKGIYTKVSRVYNNWIKETKLT					

BLAST analysis was performed on sequences from the Patp database, which is a proprietary database that contains sequences published in patents and patent publications. Patp results include those listed in Table 3E.

5

**Table 3E. Patp BLASTP Analysis for NOV3**

Sequences producing High-scoring Segment Pairs	Protein/ Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAP50311	Sequence of human factor IX, encoded by DNA FIX - Homo sapiens	461	264/264 (100%)	264/264 (100%)	1.6e-219
patp:AAP50302	Sequence of human factor IX - Homo sapiens	461	264/264 (100%)	264/264 (100%)	1.6e-219
patp:AA97295	Human clotting factor IX - Homo sapiens	461	264/264 (100%)	264/264 (100%)	1.6e-219
patp:AAB60281	Human factor IX (hFIX) protein - Homo sapiens	461	264/264 (100%)	264/264 (100%)	1.6e-219
patp:AAP50019	Sequence of human factor IX - Homo sapiens	461	263/264 (99%)	263/264 (99%)	1.1e-218

Table 3F lists the domain description from DOMAIN analysis results against NOV3.

**Table 3F. Domain Analysis of NOV3**

PSSMs producing significant alignments:	Score(bits)	Evalue
gla	77.4	2.9e-19
EGF	32.7	8.5e-06
EB	-14.5	5.4
trypsin	313.9	7.1e-99
Alignments of top-scoring domains:		
gla: domain 1 of 1, from 52 to 93: score 77.4, E = 2.9e-19		
(SEQ ID NO:97)	leelrkgnlerEcleEvCeleeArEifedtegtqefwrkYyd<--	
	+++   +   +   +   +   +   +   +	
NOV3	52 LEEFVQGNLERECLEEKCSFEAREVFENTERTEFWKQYVD	93
EGF: domain 1 of 1, from 97 to 128: score 32.7, E = 8.5e-06		
(SEQ ID NO:98)	CapnnpCsngGtCvntpggssdnfggytCeCpgGdyylsyGkrC<--	

```

      +| +| +| +| +| +| +| +| +| +|
NOV3   97  CESN-PCLNGGSKDDIN-----SYECWCPFG-----FEGKNC   128

EB: domain 1 of 1, from 79 to 128: score -14.5, E = 5.4
  (SEQ ID NO:99)  CpsgqVevnGeCvkkvaiGetGCbaseQCpgrwpGSqCidgm...C
                  +| +| +| +| ++| ++| ++| | | | ++| +|
NOV3   79  ---ENTERTTEFWKQYVDGDQ-CESNP-CLN---GGSKDDInsyec  117

                  qCpeGftavnGvC<-*
                  || || + +|
118  WCPFGF--EGKNC   128

trypsin: domain 1 of 1, from 160 to 387: score 313.9, E = 7.1e-99
  (SEQ ID NO:100) IvGGreaqpgsfgsPwqvslqvrsgggsrkhfCGGsLisenwVLTAA
                  +| | | ++| +| | | | | | | + + | | | | ++| +| +| | |
NOV3   160  VVGGEDAKPGQF--PWQVVLNGKV-----DAFCGGSIVNEKWIIVTAA  199

                  HCvsgaasapassvrVSlsvrlGehnlsltegteqkfdvkkttiivHpnyn
                  ||| + + + ++| ++| | | | ++| | | | ++| + | +| | |
200  HCVET--GVK---ITV-----VAGEHNIEETEHTEQKRNVIIR-IIPHHNIN  239

                  pdtldngaYdnDiAlLkLkspgvtlgtvrvpicLps...assdlpvGttc
                  + | +| | | | +| ++| + | ++| | | | +++++ ++ | + | ++
240  AAINK---YNHDIALLELDEP-LVLNSYVTPICIAKeyTNIFLKFSG-SG  284

                  tvsGwGrrptknlgl.sdtLqevvvpvvsretCrsayeyggtDdkvefvt
                  +| | | | | ++| ++| ++| ++| ++| ++| ++| ++| ++|
285  YVSGWGR--VFHKGGrSALVLQYLRVPLVDRATCLRS--TKFT-----IY  324

                  dnmiCagal.ggkdaCqGDSGGPLvcsgdnrdgrwlvGivSwGsygCar
                  +| | +| | | +| +| +| | | | | | | ++| + +| +| +| | + | |
325  NMFCAgFHeGGRDSCQGDSDGGPHVTEVE---GTSFLTGIISWG-EECAM  370

                  gnkPGvytrVssyldWI<-*
                  ++| +| +| +| +| ++| |
371  KGKYGIYTKVSRYVNW  387

```

The Coagulation Factor IX Precursor disclosed in this invention is expressed in at least the following tissues: Adrenal Gland/Suprarenal gland, Artery, Bone, Brain, Colon, Lung, Mammary gland/Breast, Pituitary Gland, Placenta, Spleen, Substantia Nigra, Testis, Thalamus, Thyroid, Uterus, and Whole Organism.

The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from: Hemophilia B and other diseases, disorders and conditions of the like. Additional disease indications and tissue expression for NOV3 and NOV3 variants, if available, are presented in the Examples.

Hemophilia B or Christmas disease is an X-linked condition caused by absent or reduced levels of functional coagulation factor IX. Based upon the peptide sequence of bovine factor IX, Jagadeeswaran et al. (Somat Cell Mol Genet 1984;10:465-73) synthesized a 17-base pair oligonucleotide probe to screen a human liver cDNA library. A recombinant clone was

identified with a 917-nucleotide insert whose sequence corresponds to 70% of the coding region of human factor IX. This factor IX cDNA was used to probe restriction endonuclease digested human DNA to identify a Taq I polymorphism associated with the genomic factor IX gene as well as to verify that there is a single copy of this gene per haploid genome. The factor IX cDNA was also used to map the locus for factor IX to a region from Xq26 to Xqter. The cloning of human factor IX cDNA and identification of a Taq I polymorphism and its regional localization will provide a means to study the molecular genetics of hemophilia B and permit linkage analysis with nearby loci.

#### 10 NOV4

The NOV4 (alternatively referred to as CG55936-01) nucleic acid of 1108 nucleotides (SEQ ID NO:7) encodes a novel carbonic anhydrase IV precursor-like protein and is shown in Table 4A. An open reading frame for the mature protein was identified beginning with a ATG initiation codon at nucleotides 38-40 and ending with a TGA codon at nucleotides 1046-1048. Putative untranslated regions upstream from the start codon and downstream from the termination codon are underlined in Table 4A. The start and stop codons are in bold letters.

Table 4A. NOV4 Nucleotide Sequence (SEQ ID NO:7)	
CGACCCCGGCTCAGAGGACTCTTTGCTGTCCCGCAAGATGCGGATGCTGCTGGCGCTCTGGCCCTCTCCGCGGCG	
CGGCCATCGGCCAGTGCAGAGTCACACTGGTGCTACGAGGTTCAAGCCGAGTCCTCCAACCTACCCCTGCTTGGTG	
CAGTCAAGTGGGGTGGAACTGCCAGAAGGACCGCCAGTCCCCATCAACATCGTCACCACCAAGGCAAAGTGGA	
CAAAAACTGGGACGCTTCTTCTTCTCTGGCTACGATAAGAAGCAAACGTGGACTGTCCAAAATAACGGGCACTCA	
GTGATGATGTTGCTGGAGAACAAGGCCAGCATTTCTGGAGGAGGACTGCCTGCCCATACCAGGCCAAACAGTTGC	
ACCTGCACTGGTCCGACTTGCCATATAAGGGCTCGGAGCACAGCCTCGATGGGGAGCACTTTGCCATGGAGATGCA	
CATAGTACATGAGAAAGAGAAGGGGACATCGAGGAATGTGAAAGAGGCCAGGACCTGAAGACGAAATTGCGGTG	
CTGGCCTTTCTGGTGGAGATCGGGAGAATGAACTGGCCACCACCACTGGCTCCCTGCAGACTTTCTCAAGACCCCTT	
CCCTCCCTTTCCAGGCTGGAACCCAGGTGAACGAGGGCTTCCAGCCACTGGTGGAGGCACTGTCTAATATCCCCAA	
ACCTGAGATGAGCACTACGATGGCAGAGAGCAGCCTGTTGGACCTGCTCCCCAAGGAGGAGAACTGAGGCACTAC	
TTCCGCTACCTGGGCTCACTCACCACACCGACCTGCGATGAGAAGGTGCTGCTGGACTGTGTTCCGGGAGCCATT	
AGCTTCACAGAGAACAGATCCTGGCATTCTCTCAGAAGCTGTACTACGACAAGGAACAGACAGTGAGCATGAAGGA	
CAATGTCAGGCCCTGCAGCAGCTGGGGCAGCGCACGGTGATAAAGTCCGGGGCCCCGGGTGCGCCGCTGCCTGG	
GCCCTGCCTGCCCTGCTGGGCCCCATGCTGGCCTGCCTGCTGGCCGGCTTCTGCGATGATGGCTCACTTCTGCAC	
GCAGCCTCTCTGTTGCCTCAGCTCTCCAAGTTCAGGCTTCCGG	

The NOV4 of the invention maps to chromosomes 17.

20 In a search of sequence databases, it was found, for example, that the NOV4 nucleic acid sequence of this invention has 586 of 608 bases (96%) identical to a gb:GENBANK-ID:HUMCAIVA|acc:M83670.1 mRNA from Homo sapiens (Human carbonic anhydrase IV mRNA, complete cds).

The NOV4 polypeptide (SEQ ID NO:8) encoded by SEQ ID NO:7 is 336 amino acid residues in length and is presented using the one-letter amino acid code in Table 4B. The SignalP, Psort and/or Hydropathy results predict that NOV4 has a signal peptide and is likely

to be localized in the plasma membrane with a certainty of 0.9190. In alternative embodiments, a NOV4 polypeptide is located to the lysosome membrane with a certainty of 0.2000, the endoplasmic reticulum membrane with a certainty of 0.1000, or the endoplasmic reticulum lumen with a certainty of 0.1000. The SignalP predicts a likely cleavage site for a NOV4 peptide is between amino acid positions 19 and 20, i.e. at the dash in the sequence ASA-ES.

**Table 4B. Encoded NOV4 Protein Sequence (SEQ ID NO:8)**

MRMLALLALSARPSASAESHWCYEVQAESSNYPCLVPVKWGGNCQKDRQSPINIVTTKAKVDKKLGRFFFSGY  
DKKQTTWTQNNGHVSMMLLENKASISGGGLPAPYQAKQLHLHWSLDLYKGSEHSLDGEHFAMEMHIVHEKEKGT  
RNVKEAQDPDEIAVLAFLVEIGRMNWPPPLAPCRLSQDPSLPFQAGTQVNEGFQPLVEALSNIKPEMSTTMAE  
SSLLDLLPKKEELRHYFRYLGSLTTPCTCEKVWVTVFREPIQLHREQILAFSQKLYYDKEQTVSMKDNVRPLQQL  
GQRTVIKSGAPGRPLPWALPALLGPMLACLLAGFLR

The full amino acid sequence of the disclosed protein of the invention has 172 of 173 amino acid residues (99%) identical to, and 172 of 173 amino acid residues (99%) similar to, the 312 amino acid residue ptnr:SWISSNEW-ACC:P22748 protein from Homo sapiens (Human) (CARBONIC ANHYDRASE IV PRECURSOR (EC 4.2.1.1) (CARBONATE DEHYDRATASE IV) (CA-IV)).

The amino acid sequence of NOV4 has high homology to other proteins as shown in Table 4C.

**Table 4C. NOV4 BLASTP Results**

Gene Index/ Identifier	Protein/Organism	Length of aa	Identity (%)	Positives (%)	Expect Value
P22748	Carbonic anhydrase IV precursor (EC 4.2.1.1) (Carbonate dehydratase IV) (CA-IV) - Homo sapiens	312	172/173 (99%)	172/173 (99%)	7.2e-167
Q95323	Carbonic anhydrase IV precursor (EC 4.2.1.1) (Carbonate dehydratase IV) (CA-IV) - Bos taurus (Bovine)	312	125/203 (61%)	144/203 (70%)	3.4e-113
P48283	Carbonic anhydrase IV precursor (EC 4.2.1.1) (Carbonate dehydratase IV) (CA-IV) - Oryctolagus cuniculus (Rabbit)	308	119/176 (67%)	135/176 (76%)	4.5e-107
P48284	Carbonic anhydrase IV precursor (EC 4.2.1.1) (Carbonate dehydratase IV) (CA-IV) - Rattus norvegicus (Rat)	309	96/173 (55%)	126/173 (72%)	3.0e-93
Q64444	Carbonic anhydrase IV precursor (EC 4.2.1.1) (Carbonate dehydratase IV) (CA-IV) - Rattus norvegicus (Rat)	305	94/173 (54%)	120/173 (69%)	1.3e-88



	IV) (CA-IV) - Mus musculus (Mouse)				
--	---------------------------------------	--	--	--	--

A multiple sequence alignment is given in Table 4D in a ClustalW analysis comparing NOV4 with related protein sequences disclosed in Table 4C.

5 **TABLE 4D. CLUSTALW ANALYSIS OF NOV4**

1. SEQ ID NO.: 8 NOV4  
2. SEQ ID NO.: 101 P22748  
3. SEQ ID NO.: 102 Q95323  
4. SEQ ID NO.: 103 P48283  
5. SEQ ID NO.: 104 P48284  
6. SEQ ID NO.: 105 Q64444

10

		10	20	30	40	50	60	
NOV4	MRMLLALLALS	SAARPSASA	ESHWCYEVOA	ESSNYPC	LVVPVKWGC	NCQKDR	QSPINIVT	TK 60
P22748	MRMLLALLALS	SAARPSASA	ESHWCYEVOA	ESSNYPC	LVVPVKWGC	NCQKDR	QSPINIVT	TK 60
Q95323	MRLLALLLVLA	AAPPQARA	ASHWCYQIQ	VKPSNYT	CLEPDE	WEGSCON	NRQSPN	IVTAK 60
P48283	MOLLFALLAL	GALRPLAGE	PLHWCYEIQ	A--SNYS	CLGPD	KWQEDC	QKSRQSP	INIVTAK 58
P48284	MOLLFALLAL	AYVAPST	-EDSHWC	YEIQAKE	PNSHCS	GPEQWT	GDCCKNC	QSPINIVT 59
Q64444	MOLLFALLAL	AYVAPST	-EDSGWC	YEIQAK	EPNSH	CSGPEQ	WTGDC	CKNCQSP 59
		70	80	90	100	110	120	
NOV4	AKVDKKLGR	FFFSGYD	KKKTWIV	VONNGH	SVMML	LENKAS	ISGGGL	PAPYQAK 120
P22748	AKVDKKLGR	FFFSGYD	KKKTWIV	VONNGH	SVMML	LENKAS	ISGGGL	PAPYQAK 120
Q95323	TDIDPNLGR	SFSGYD	KKKTWIV	VONNGH	SVMML	LENKPS	IAGGGL	STRYCAT 120
P48283	AEVDHSLGR	FFFSGYD	QREARL	VONNGH	SVMML	LENKPS	IAGGGL	STRYCAT 118
P48284	TKLNPSLT	PFTEVGY	DQKKKWE	VNNQHS	VEMSL	GEDIYI	FGGDL	PTQYKAT 119
Q64444	TKVNPRLT	PFTEVGY	DQKKKWE	VNNQHS	VEMSL	GEDIYI	FGGDL	PTQYKAT 119
		130	140	150	160	170	180	
NOV4	LPHYKGEHS	LDGEHF	FAMEMH	IVHKE	BKGT	SRNVKE	AQDPED	ETIAVLAF 180
P22748	LPHYKGEHS	LDGEHF	FAMEMH	IVHKE	BKGT	SRNVKE	AQDPED	ETIAVLAF 173
Q95323	AMDRGSEHS	LDGERF	FAMEMH	IVHKE	BKGT	SGNAS	NOFADE	ETIAVLAF 173
P48283	ELDRGSEHS	LDGERS	FAMEMH	IVHKE	BKGT	SGNAS	NOFADE	ETIAVLAF 169
P48284	ESNKGSEHS	LDGKHF	FAMEMH	IVHKE	BKMT	TGDKVQ	--DSDS	KDKIAVLAF 170
Q64444	GNDRGSEHS	LDGRHF	FAMEMH	IVHKE	BKMT	TGDKVQ	--DSDS	KDKIAVLAF 166
		190	200	210	220	230	240	
NOV4	LAPCRLS	QDPSLP	FQAGT	OVNEG	FQPL	VEALS	SNIPKE	MSTTMAES 239
P22748	LAPCRLS	QDPSLP	FQAGT	OVNEG	FQPL	VEALS	SNIPKE	MSTTMAES 215
Q95323	-----	-----	-----	TOVNE	GFOPL	VEALS	SNIPKE	MSTTMAES 215
P48283	-----	-----	-----	PTMNE	GFOPL	VEALS	SNIPKE	MSTTMAES 211
P48284	-----	-----	-----	NEVNE	GFOPL	VEALS	SNIPKE	MSTTMAES 212
Q64444	-----	-----	-----	DKVNE	GFOPL	VEALS	SNIPKE	MSTTMAES 208
		250	260	270	280	290	300	
NOV4	HYFRYL	GSLTTP	TCDEK	VVWTV	FEPI	OLHRE	QILAFS	OKLYYD 299
P22748	HYFRYL	GSLTTP	TCDEK	VVWTV	FEPI	OLHRE	QILAFS	OKLYYD 275
Q95323	HYFRYL	GSLTTP	TCDEK	VVWTV	FEPI	OLHRE	QILAFS	OKLYYD 275
P48283	HYFRYL	GSLTTP	TCDEK	VVWTV	FEPI	OLHRE	QILAFS	OKLYYD 271
P48284	AYFRYL	GSLTTP	TCDEK	VVWTV	FEPI	OLHRE	QILAFS	OKLYYD 272
Q64444	TYFRYL	GSLTTP	TCDEK	VVWTV	FEPI	OLHRE	QILAFS	OKLYYD 268

5  
 10  
 NOV4 LGORTVIKSGAPGRPLPWALPALLGPMLACLHAGFLR 336  
 P22748 LGORTVIKSGAPGRPLPWALPALLGPMLACLHAGFLR 312  
 Q95323 LGOROVFRSGAPGLLLAQPLPTLLAPVLACTVGFLLR 312  
 P48283 LGDRSVFKSQAAGOLLPLPLPTLLVPTLACVMAQLLR 308  
 P48284 LGNROVFRSHASGRLLSLPLPTLLVPTLTCLVASFLH 309  
 Q64444 LGNROVFKSHAPGOLLPLPLPTLLVPTLTCLVANFLQ 305

Additional BLAST results are shown in Table 4E.

Table 4E. Patp BLASTP Analysis for NOV4					
Sequences producing High-scoring Segment Pairs	Protein/ Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAB59591	Human carbonic anhydrase isoform	268	154/155 (99%)	154/155 (99%)	1.3e-143
patp:AAB54035	Human pancreatic cancer antigen protein sequence	198	133/154 (86%)	135/154 (87%)	3.8e-69
patp:AAR91952	Lung cancer specific antigen HCAVIII truncated protein	270	50/126 (39%)	73/126 (57%)	2.8e-32
patp:AAR91953	Lung cancer specific antigen HCAVIII truncated protein	274	50/126 (39%)	73/126 (57%)	2.8e-32
patp:AAR91950	Lung cancer specific antigen HCAVIII pre-protein	354	59/174 (33%)	90/174 (51%)	1.1e-30

15  
 Domain results for NOV4 were collected from the Pfam database, and then identified by the Interpro domain accession number. The results are listed in Table 4F with the statistics and domain description. These results indicate that the NOV4 polypeptide has properties similar to those of other proteins known to contain these domains.

TABLE 4F. DOMAIN ANALYSIS OF NOV4		
PSSMs Producing Significant Alignments	Score (bits)	E Value
carb_anhydrase: domain 1 of 2, from 23 to 176	294.4	1.4e-84



The novel NOV4 nucleic acids and polypeptides of the invention, or fragments thereof, are useful in diagnostic applications, wherein the presence or amount of the nucleic acid or the protein are to be assessed. These materials are further useful in the generation of antibodies that bind immunospecifically to the novel substances of the invention for use in therapeutic or diagnostic methods. These antibodies may be generated according to methods known to one ordinarily skilled in the art, using prediction from hydrophobicity charts, as described in the “Anti-NOVX Antibodies” section below.

The disclosed NOV4 protein of the invention has multiple hydrophilic regions, each of which can be used as an immunogen. The NOV4 protein also has value in the development of a powerful assay system for functional analysis of various human disorders, which will help in understanding of pathology of the disease and development of new drug targets for various disorders.

Carbonic anhydrases form a large family of genes encoding zinc metalloenzymes of great physiologic importance. As catalysts of the reversible hydration of carbon dioxide, these enzymes participate in a variety of biologic processes, including respiration, calcification, acid-base balance, bone resorption, and the formation of aqueous humor, cerebrospinal fluid, saliva, and gastric acid. Thus, it is likely that the NOV4 protein of the invention is accessible to a diagnostic probe and for the various therapeutic applications described herein.

## NOV5

The NOV5 nucleic acid of 1806 nucleotides (SEQ ID NO:9) (alternatively referred to as CG55784-01) encodes a novel neural cell adhesion molecule-like protein and is shown in Table 5A. An open reading frame for the mature protein was identified beginning with an AAC initiation codon at nucleotides 1-3 and ending with a TAA codon at nucleotides 1645-1647. Putative untranslated regions downstream from the termination codon are underlined in Table 5A. The start and stop codons are in bold letters.

**Table 5A. NOV5 Nucleotide Sequence (SEQ ID NO:9)**

<p><b>AAC</b>AAAGCCATCCCCGAGGAAAGGAGACGTCGGTCACCATTTGACATCCAGCACCCCTCCACTGGTCAACCTCTCGG  TGGAGCCACAGCCAGTGCTGGAGGACAACGTCGTCACCTTTCCACTGCTCTGCAAAGGCCAACCAGCTGTACCCCA  GTACAGGTGGGCCAAGCGGGCCAGATCATCAAGGAGGCATCTGGAGAGGTGTACAGGACCACAGTGGACTACACG  TACTTCTCAGAGCCCGTCTCCTGTGAGGTGACCAAAGCCCTGGGCAGCACCAACCTCAGCCGCACGGTTGACGTCT  ACTTTGGGCCCCGGATGACCACAGAACCCCAATCCTTGCTCGTGGATCTGGGCTCTGATGCCATCTTAAGCTGCGC  CTGGACCGGCAACCCATCCCTGACCATCGTCTGGATGAAGCGGGGCTCCGGAGTGGTCTGAGCAATGAGAAGACC  CTGACCCTCAAATCCGTGCGCCAGGAGGACGCGGGCAAGTACGTGTGCCGGGCTGTGGTCCCCGTGTGGGAGCCG  GGGAGAGAGAGGTGACCTGACCGTCAATGGACCCCCATCATCTCCAGCACCCAGACCAGCACGCCCTCCACGG  CGAGAAGGGCCAGATCAAGTGCTTCATCCGAGCACGCCGCCGCGGACCGCATCGCCTGGTCTCTGGAAGGAGAAC  GTTCTGGAGTCGGGCACATCGGGGCGCTATACGGTGGAGACCATCAGCACCGAGGAGGGCGTCATCTCCACCCTGA  CCATCAGCAACATCGTGGGGCCGACTTCCAGACCATCTACAATGCACGGCCTGGAACAGCTTCGGCTCCGACAC</p>
--

TGAGATCATCCGGCTCAAGGAGCAAGGTTTCGGAAATGAAGTCGGGAGCCGGGCTGGAAGCAGAGTCTGTGCCGATG  
 GCCGTATCATTTGGGGTGGCCGTAGGAGCTGGTGTGGCCTTCCTCGTCCCTTATGGCAACCATCGTGGCGTTCTGCT  
 GTGCCCCGTTCCAGAGAAATCTCAAAGGTGTTGTGTACGCCAAAAATGATATCCGAGTGGAATTTGCCACAAGGA  
 ACCAGCCTCTGGTCCGGGAGGGTGAGGAGCACTCCACCATCAAGCAGCTGATGATGGACCGGGGTGAATTCCAGCAA  
 GACTCAGTCTGAAACAGCTGGAGGTCTCAAAGAAGAGGAGAAAGAGTTTCAGAACCTGAAGGACCCACCAATG  
 GCTACTACAGCGTCAACACCTTCAAAGAGCACCCTCAACCCCGACCATCTCCCTCTCCAGCTGCCAGCCCGACCT  
 GCGTCTTGCAGGCAAGCAGCGTGTGCCACAGGCATGTCTTACCAACATCTACAGCACCTGAGCGGCCAGGGC  
 CGCCTCTACGACTACGGGCAGCGGTTTGTGTGGGCATGGGCAGCTCGTCCATCGAGCTTTGTGAGCGGGAGTTCC  
 AGAGAGGCTCCCTCAGCGACAGCAGCTCCTTCTGGACACGCAGTGTGACAGCAGCGTCAGCAGCAGCGGCAAGCA  
 GGATGGCTATGTGCAGTTCGACAAGGCCAGCAAGGCTTCTGCTTCTCTCCACCACTCCAGTCTCGTCCCAG  
 AACTCTGACCCAGTCGACCCCTGCAGCGGCGGATGCAGACTCACGTCTAAGGATCACACACCGCGGGTGGGGACG  
 GGCCAGGGAAGAGGTGAGGGCACGTCTGTTGTCCAGGGACTGTGGGGTACTTTACAGAGGACACCAAGATGGCC  
 CACTTCCAGGACAGCCTCCAGCGCCTCTGCCACTGCCTTCTCGAAGCTCTGATCA

The NOV5 of the invention maps to chromosome 11.

In a search of sequence databases, it was found, for example, that the NOV5 nucleic acid sequence of this invention has 564 of 919 bases (61%) identical to a gb:GENBANK-

5 ID:AK022708|acc:AK022708.1 mRNA from Homo sapiens (Homo sapiens cDNA FLJ12646  
 fis, clone NT2RM4001987, weakly similar to NEURAL CELL ADHESION MOLECULE 1,  
 LARGE ISOFORM PRECURSOR).

10 The NOV5 polypeptide (SEQ ID NO:10) encoded by SEQ ID NO:9 is 548 amino acid  
 residues in length and is presented using the one-letter amino acid code in Table 5B. The  
 SignalP, Psort and/or Hydropathy results predict that NOV5 has no known signal peptide and  
 is likely to be localized in the plasma membrane with a certainty of 0.7000. In alternative  
 embodiments, a NOV5 polypeptide is located to the endoplasmic reticulum membrane with a  
 certainty of 0.2000, or the mitochondrial inner membrane with a certainty of 0.1000.

**Table 5B. Encoded NOV5 Protein Sequence (SEQ ID NO:10)**

NKAIPGGKETSVTIDIQHPPLVNLSEVPQPVLEDNVVTFHCSAKANPAVTQYRWAKRGQIIKEASGEVYRTTVDY  
 TYFSEPVSCVTKALGSTNLRSRTVDVYFGPRMTTEPQSLLDLGSDDLSCAWTGNPSLTIVWMKRGSGVVLSE  
 KTLTLKSVRQEDAGKYVCRAVVPVVGAGEREVLTVNGPPIISSTQTHALHGEKGQIKCFIRSTPPPDRIAWS  
 KENVLESSTSGRYTVETISTEEGVISTLTISNIVRADFQTIYNCTAWNSFGSDTEIIRLKEQSGEMKSGAGLEAE  
 SVPMAVIIGVAVGAGVAFVLMTATVAFCCARSQRNLKGVVSAKNDIRVEIVHKEPASGREGEHSTIKQLMMDR  
 GEFQQDSVLKQLEVLKEEEKBFQNLKDPNTNGYYSVNTFKEHSTPTISLSSCQPDLRPAGKQRPVPTGMSFTNIYS  
 TLGQGRLYDYGQRFVLGMGSSSIELCEREFQRGSLSDSSSFLDTQCDSSVSSSGKQDGYVQFDKASKASASSSH  
 HSQSSSQNSDPSRPLQRRMQTHV

15 The full amino acid sequence of the disclosed protein of the invention has 244 of 570  
 amino acid residues (42%) identical to, and 334 of 570 amino acid residues (58%) similar to,  
 the 571 amino acid residue ptnr:TREMBLNEW-ACC:BAB14192 protein from Homo sapiens  
 (Human) (CDNA FLJ12646 FIS, CLONE NT2RM4001987, WEAKLY SIMILAR TO  
 20 NEURAL CELL ADHESION MOLECULE 1, LARGE ISOFORM PRECURSOR).

The amino acid sequence of NOV5 has high homology to other proteins as shown in Table 5C.

Table 5C. NOV5 BLASTP Results					
Gene Index/ Identifier	Protein/Organism	Length of aa	Identity (%)	Positives (%)	Expect Value
Q96JG0	KIAA1867 PROTEIN - Homo sapiens (Human)	779	546/548 (99%)	546/548 (99%)	1.6e-292
Q9H9N1	NT2RM4001987 PROTEIN - Homo sapiens (Human)	571	244/570 (42%)	334/570 (58%)	5.3e-104
Q96J84	NEPH1 - Homo sapiens (Human)	605	198/386 (51%)	256/386 (66%)	9.2e-100
Q9NVA5	NT2RP4001372 PROTEIN - Homo sapiens (Human)	410	169/410 (41%)	236/410 (57%)	4.2e-63
Q923L4	NEPH1 - Mus musculus (Mouse)	392	90/166 (54%)	113/166 (68%)	2.4e-46

A multiple sequence alignment is given in Table 5D in a ClustalW analysis comparing NOV5 with related protein sequences disclosed in Table 5C.

5

**TABLE 5E. CLUSTALW ANALYSIS OF NOV5**

	1. SEQ ID NO.: 10	NOV5	4. SEQ ID NO.: 110	Q96J84
	2. SEQ ID NO.: 108	Q96JG0	5. SEQ ID NO.: 111	Q9NVA5
	3. SEQ ID NO.: 109	Q9H9N1	6. SEQ ID NO.: 112	Q923L4
10				
		10 20 30 40 50 60		
	NOV5	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....		1
15	Q96JG0	GMKPFQLDLLFVCFLLFSQELGLQKRGCCCLVLGYMAKDKFRMRNEGQVYSFSQQPQDQVV	60	1
	Q9H9N1	----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- -----		1
	Q96J84	----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- -----		1
	Q9NVA5	----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- -----		1
	Q923L4	----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- -----		1
20				
		70 80 90 100 110 120		
	NOV5	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....		1
25	Q96JG0	VSGQPVTLLCAIPEYDGFVLWIKDGLALGVGRDLSSYPQYLVVGNHLSGEHHLKILRAEL	120	1
	Q9H9N1	----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- -----		1
	Q96J84	----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- -----		1
	Q9NVA5	----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- -----		1
	Q923L4	----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- -----		1
30				
		130 140 150 160 170 180		
	NOV5	..... ..... ..... ..... ..... ..... ..... ..... ..... ..... ..... .....		1
	Q96JG0	QDDAVYECQAIQAAIRSRPARLTVLVPDDPVILGGPVISLRAGDPLNLTCHADNAKPAA	180	1

5

Q9H9N1 ----- 1  
Q96J84 ----- 1  
Q9NVA5 ----- 1  
Q923L4 ----- 1

10

190 200 210 220 230 240  
.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|  
NOV5 -----NKAIPGGKE 9  
Q96JG0 SIIWLRLKGEVINGATYSKTLRLDGRKRESIVSTLFIISPGDVENGQSIVCRATNKAIPGGKE 240  
Q9H9N1 -----MNEAIPSGKE 10  
Q96J84 ----- 1  
Q9NVA5 ----- 1  
Q923L4 ----- 1

15

250 260 270 280 290 300  
.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|  
NOV5 TSVTIDIQHPPLVNLVSVEPQPVLVDNVVTFHCSAKANPAVTQYRWAKRGQIIKEASGEVY 69  
Q96JG0 TSVTIDIQHPPLVNLVSVEPQPVLVDNVVTFHCSAKANPAVTQYRWAKRGQIIKEASGEVY 300  
Q9H9N1 TSIELDVHHPTVTLTSLIEPQTVQEGERVVFTCQATANPEILGYRWAKGGFLIEDAHESRY 70  
Q96J84 ----- 1  
Q9NVA5 ----- 1  
Q923L4 ----- 1

20

310 320 330 340 350 360  
.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|  
NOV5 RTTVDYTYFSEPVSCVTKALGSTNLRSRTVDVYFGPRMTTEPQSLLVDLGSDAILSCAWT 129  
Q96JG0 RTTVDYTYFSEPVSCVTKALGSTNLRSRTVDVYFGPRMTTEPQSLLVDLGSDAIFSCAWT 360  
Q9H9N1 ETNVDSFFTEPVSCVHNKVGSTNVSTLVNVHFAPRIVVDPKPTTTDIGSDVTLTLCVWV 130  
Q96J84 ----- 1  
Q9NVA5 ----- 1  
Q923L4 ----- 1

25

370 380 390 400 410 420  
.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|  
NOV5 GNPSLTIVWMK-----RGSGVLSNEKTLTLKSVRQEDACKYVVCRAVVP 173  
Q96JG0 GNPSLTIVWMK-----RGSGVLSNEKTLTLKSVRQEDACKYVVCRAVVP 404  
Q9H9N1 GNPPLTLTWTKKDSNMGPRPPGSPPEAALSAQVLSNQILLKSVTQADACTYTCRAIVP 190  
Q96J84 -----MLSLLVWILTLSDTFSOGTQTRFSQEPADQ 30  
Q9NVA5 -----MVLSNSNQILLKSVTQADACTYTCRAIVP 29  
Q923L4 -----MWAPHLVWYALIFVTLALALPGTQTRFSQEPADQ 34

30

430 440 450 460 470 480  
.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|  
NOV5 RVGAGEREVT--LTVNGPPIISSTQTOHALHGEKGOIKCFIRSTPPPDRIAWSWKENVLE 231  
Q96JG0 RVGAGEREVT--LTVNGPPIISSTQTOHALHGEKGOIKCFIRSTPPPDRIAWSWKENVLE 462  
Q9H9N1 RIGVAEREVP--LYVNGPPIISSEAVQAVRGDGGKVECFIGSTPPPDRIAWAWKENFLE 248  
Q96J84 TVVAGORAVLPCVLLNYSGIVQWTKDGLAL-GMGOGLKAMPYRVVGSADAGQYNLEITD 89  
Q9NVA5 RIGVAEREVP--LYVNGPPIISSEAVQAVRGDGGKVECFIGSTPPPDRIAWAWKENFLE 87  
Q923L4 TVVAGORAVLPCVLLNYSGIVQWTKDGLAL-GMGOGLKAMPYRVVGSADAGQYNLEITD 93

35

490 500 510 520 530 540  
.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|  
NOV5 SGTSGRYTVETISTEEGVISTLTISNIVRADFQTIYNCTAWNSFGSDTEIIRLKEOGSEM 291  
Q96JG0 SGTSGRYTVETISTEEGVISTLTISNIVRADFQTIYNCTAWNSFGSDTEIIRLKEOGSEM 522  
Q9H9N1 VGTLERYTVERTNSGSGVLSTLTINNVMEADFQTHYNCTAWNSFGPGTAT--IQLE--- 302  
Q96J84 AELSDDASYEQATEAALRSRRRAKLTVIPPEDTRIIGGPVILLOAGTPHN-LTCR--- 144  
Q9NVA5 VGTLERYTVERTNSGSGVLSTLTINNVMEADFQTHYNCTAWNSFGPGTAT--IQLE--- 141  
Q923L4 AELSDDASYEQATEAALRSRRRAKLTVIPPEDTRIIGGPVILLOAGTPYN-LTCR--- 148

40

550 560 570 580 590 600  
.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|.....|  
NOV5 KSGAGLEAESVPMAYIIGVAVGAGVAFVLMATVAFCCARSORNLKGVVSAKNDI-RVE 350  
Q96JG0 KSGAGLEAESVPMAYIIGVAVGAGVAFVLMATVAFCCARSORNLKGVVSAKNDI-RVE 581

45

55

60







The neural cell adhesion molecule disclosed in this invention is expressed in at least the following tissues: amygdala, brain, placenta, spinal chord. In addition, the sequence is predicted to be expressed in the following tissues because of the expression pattern of (GENBANK-ID: gb:GENBANK-ID:AK022708|acc:AK022708.1) a closely related Homo sapiens cDNA FLJ12646 fis, clone NT2RM4001987, weakly similar to NEURAL CELL ADHESION MOLECULE 1, LARGE ISOFORM PRECURSOR homolog in species Homo sapiens: kidney.

The protein similarity information, expression pattern, and map location for the NOV5 protein and nucleic acid disclosed herein suggest that this protein may have important structural and/or physiological functions characteristic of the cell adhesion molecule family. Therefore, the NOV5 nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications and as a research tool. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from: Von Hippel-Lindau (VHL) syndrome, Alzheimer's disease, stroke, tuberous sclerosis, hypercalcaemia, Parkinson's disease, Huntington's disease, cerebral palsy, epilepsy, Lesch-Nyhan syndrome, multiple sclerosis, ataxia-telangiectasia, leukodystrophies, behavioral disorders, addiction, anxiety, pain, neuroprotection, fertility, diabetes, autoimmune disease, renal artery stenosis, interstitial nephritis, glomerulonephritis, polycystic kidney disease, systemic lupus erythematosus, renal tubular acidosis, IgA nephropathy, hypercalcaemia, and other diseases, disorders and conditions of the like.

The novel NOV5 nucleic acids and polypeptides of the invention, or fragments thereof, are useful in diagnostic applications, wherein the presence or amount of the nucleic acid or the protein are to be assessed. These materials are further useful in the generation of antibodies that bind immunospecifically to the novel substances of the invention for use in therapeutic or diagnostic methods. These antibodies may be generated according to methods known to one ordinarily skilled in the art, using prediction from hydrophobicity charts, as described in the "Anti-NOVX Antibodies" section below.

The disclosed NOV5 protein of the invention has multiple hydrophilic regions, each of which can be used as an immunogen. The NOV5 protein also has value in the development of a powerful assay system for functional analysis of various human disorders, which will help in understanding of pathology of the disease and development of new drug targets for various disorders.

Neural cell adhesion molecules (NCAM) are members of the cell adhesion molecule family with homology to the immunoglobulin protein superfamily. They play critical roles in neuronal outgrowth, differentiation and development, as well as oligodendrocyte maturation and myelination, probably by modulating cell-cell interactions. NCAMs can also reorganize the extra-cellular space and cause disturbances that drive the development of brain pathology in conditions such as Alzheimer's disease and multiple sclerosis. Disease-causing mutations and gene knock-out studies further substantiat that neural cell adhesion molecules are required for axon guidance, brain plasticity, long term potentiation, learning and neuron regeneration. Therefore, these proteins are essential for brain function and may be used as therapeutic targets in that context.

## NOV6

The NOV6 nucleic acid (SEQ ID NO:11) (alternatively referred to as CG55916-01) of 2405 nucleotides encodes a novel phospholipase C delta-like protein and is shown in Table 6A. An open reading frame for the mature protein was identified beginning with a ATG initiation codon at nucleotides 153-155 and ending with a TGA codon at nucleotides 2361-2363. Putative untranslated regions upstream from the start codon and downstream from the termination codon are underlined in Table 6A. The start and stop codons are in bold letters.

**Table 6A. NOV6 Nucleotide Sequence (SEQ ID NO:11)**

GCGGCCGCTGGAGGCGTTGCCGCCGCCCGCCCGAGGAGCCCCGGTGGCCGCCAGGTCGCAGCCCCAAGT
CGCGGCGCCGGTTCGCTCTCCCGTCCCCGCCGACTCCCTCCGATGGCGGCACCAAGAGGCCCGGGCTGCGG
GCGCTGAAGAAGATGGGCTGACGGAGGACGAGGACGTGCGGCCATGCTGCGGGGCTCCCGCTCCGCA
AGATCCGCTCGCGCACGTGGCACAAGGAGCGGCTGTACCGGCTGCAGGAGGACGGCCTGAGCGTGTGGTT
CCAGCGGCGCATCCCGCTGCGCCATCGCAGCACATCTTCTTCGTGCAGCACATCGAGGCGGTCCGCGAG
GGCCACCAGTCCGAGGGCCTGCGGCGCTTCGGGGGTGCCTTCGCGCCAGCGCGCTGCCTCACCATCGCCT
TCAAGGCCGCCGCAAGAACCTGGACCTGGCGGCGCCACGGCTGAGGAAGCGCAGCGCTGGGTGCGCGG
TCTGACCAAGCTCCGCGCGCGCCTGGACGCCATGAGCCAGCGCAGCGGCTAGACCAATGGATCCACTCC
TATCTGCACCGGGCTGACTCCAACCAGGACAGCAAGATGAGCTTCAAGGAGATCAAGAGCCTGCTGAGAA
TGGTCAACGTGGACATGAACGACATGTACGCCTACCTCCTCTTCAAGGAGTGTGACCACTCCAACAACGA
CCGTCTAGAGGGGGCTGAGATCGAGGAGTTCCTGCGGCGGCTGCTGAAGCGGCCGAGCTGGAGGAGATC
TTCCATCAGTACTCGGGCGAGGACCGCGTGTGAGTGCCCTGAGCTGCTGGAGTTCCTGGAGGACCAGG
GCGAGGAGGGCGCCACACTGGCCCGCGCCAGCAGCTCATTAGACCTATGAGCTCAACGAGACAGCCCC
TGCAGCCAAGCAGCATGAGCTGATGACACTGGATGGCTTCATGATGTACCTGTTGTGCGCCGAGGGGGCT
GCCTTGGACAACACCCACACGTGTGTGTTCCAGGACATGAACCAGCCCCCTTGCCCACTACTTCATCTCTT
CCTCCCAACACCTATCTGACTGACTCCCAGATCGGGGGGCCAGCAGACCGAGGCCTATGTTAGGGC
CTTTGCCCAGGGATGCCGCTGCGTGGAGCTGGACTGCTGGGAGGGGCCAGGAGGGGAGCCCGTCATCTAT
CATGGCCATACCCTCACCTCCAAGATTCTCTTCCGGGACGTGGTCCAAGCCGTGCGCGACCATGCCTTCA
CGGTGAGCCCTTACCCTGTCTATCCTATCCCTGGAGAACCACTGCGGGCTGGAGCAGCAGGCTGCCATGGC
CCGCCACCTCTGCACCATCCTGGGGGACATGCTGGTGACACAGGCGCTGGACTCCCCAAATCCCAGGAG
CTGCCATCCCCAGAGCAGCTGAAGGGCCGGTCTGTTGAAGGAAAGAGTTGCCCGCTGCTCGGAGCG
AGGATGGCCGGGCTCTGTGCGATCGGGAGGAGGAGGAGGAGGATGACGAGGAGGAAGAAGAGGAGGTGGA
GGCTGCAGCGCAGAGGCAGATCTCCCCGAGCTGTGCGCCCTGGCTGTGTACTGCCACGCCACCCGCTG
CGACCCGACACATCACCTGGAGGACTAGGAAGCAGCCAGGTGAAGAGGGGAGAGCGCTTTCAGACAGGA
GGAACAGGTTGTTGAAGGCCTGGGGGAACAGCTTTGTAGGCACAATGCCCGCCAGCTGACCCGCGTGTA
CCCGCTGGGGCTGCGGATGAACCTAGCCAACTACAGTCCCCAGGAGATGTGGAACCTGGGCTGTGAGCTG
GTGGCCTTGAACCTTCCAGACGCCAGGCTACGAGATGGACCTCAATGCCGGGCGCTTCCTAGTCAATGGGC
AGTGTGGCTACGTCCTAAACCTGCCTGCCTGCGGCAACCTGACTCGACCTTTGACCCCGAGTACCAGG

ACCTCCCAGAACCACTCTCAGCATCCAGGTGCTGACTGCACAGCAGCTGCCCCAAGCTGAATGCCGAGAAG  
 CCACACTCCATTGTGGACCCCTGGTGCGCATTGAGATCCATGGGGTGCCCGCAGACTGTGCCCGGCAGG  
 AGACTGACTACGTGCTCAACAATGGCTTCAACCCCGCTGGGGGCAGACCCTGCAGTTCCAGCTGCGGGC  
 TCCGGAGCTGGCACTGGTCCGGTTTGTGGTGGAAGATTATGACGCCACCTCCCCAATGACTTTGTGGGC  
 CAGTTTACACTGCCTCTTAGCAGCCTAAAGCAAGGGTACCGCCACATACACCTGCTTCCAAGGACGGGG  
 CCTCACTGTACACAGCCACGCTCTTCATCCAAATCCGCATCCAGCGCTCCTGAGGGCCACCTCACTCGC  
 CTTGGGGTTCTGCGAGTGCCAGTCC

The NOV6 of the invention maps to chromosomes 17.

In a search of sequence databases, it was found, for example, that the NOV6 nucleic acid sequence of this invention has 956 of 1425 bases (67%) identical to a acc:U09117.1 mRNA from human (Human phospholipase C delta 1 mRNA, complete cds - Homo sapiens, 2627 bp).

The NOV6 polypeptide (SEQ ID NO:12) encoded by SEQ ID NO:11 is 736 amino acid residues in length and is presented using the one-letter amino acid code in Table 6B. The SignalP, Psort and/or Hydropathy results predict that NOV6 has no known signal peptide and is likely to be localized in the mitochondrial matrix space with a certainty of 0.3600. In alternative embodiments, a NOV6 polypeptide is located to the microbody (peroxisome) with a certainty of 0.3000, or the lysosome (lumen) with a certainty of 0.1626.

**Table 6B. Encoded NOV6 Protein Sequence (SEQ ID NO:12)**

MGLTEDEDVRAMLRGSRRLRKIRSRTWHKERLYRLQEDGLSVWFQRRIPRAPSQHIFVQHIEAVREGHQSEGLRR  
 FGGAFAPARCLTIAPKGRRNLDLAAPTAEAAQRWVRGLTKLRARLDAMSQRERLDQWIHSYLHRADSNQDSKMS  
 FKEIKSLLRMVNVDMDMYAYLLFKECDHSNDRLEGAEIEEFLLRLLKRPELEEIFHQYSGEDRVLSAPELLE  
 LEDQGEAGTLARAQQLIQTYELNETAPAAQHELMTLTGFM MYLLSPEGAALDNTHTCVFQDMNQPLAHYFISS  
 SHNTYLTDSQIGGPSSTEAYVRAFAQGCRCVELDCWEGPGGEPVIYHGHTLTSKILFRDVVQAVRDHAFTVSPYP  
 VILSLENHCGLEQQAAMARHLCTILGDMLVTQALDSPNPEELPSPEQLKGRVLVKGKLPAAARSEDGRALSDREE  
 EEDDEDEEEVEAAAQRQISPELSALAVYCHATRLRPDTSPPGLGSSQVKRGERFPDRNRLLKAWGNSFVRHN  
 ARQLTRVYPLGLRMNSANYSPOEMWNSGCQLVALNFQTPGYEMDLNAGRFLVNGQCGYVLKPACLRQPDSTFDPE  
 YPGPRTTSLIQVLTAQQLPKLNAEKPHSIVDPLVRIEIHGVPADCARQETDYLNNGFNPRWGQTLQFQLRAPE  
 LALVRFVVEDYDATSPNDFVQGFTLPLSSSLKQGYRHIHLLSKDGASLSPATLFIQIRIQRS

The full amino acid sequence of the disclosed protein of the invention has 388 of 744 amino acid residues (52%) identical to, and 511 of 744 amino acid residues (68%) similar to, the 756 amino acid residue ptrn:SPTREMBL-ACC:Q9Z1B4 from mouse (PHOSPHOLIPASE C-DELTA1).

The amino acid sequence of NOV6 has high homology to other proteins as shown in Table 6C.

**Table 6C. NOV6 BLASTP Results**

Gene Index/ Identifier	Protein/Organism	Length of aa	Identity (%)	Positives (%)	Expect Value
	SEQUENCE 1 FROM		707/736	713/736	

CAC88658	PATENT WO0166764 - Homo sapiens (Human)	736	(96%)	(96%)	0.0
Q96FL6	SIMILAR TO PHOSPHOLIPASE C, DELTA - Homo sapiens (Human)	2998	584/613 (95%)	590/613 (96%)	3.1e-312
Q60450	PHOSPHOLIPASE C-DELTA1 - Cricetulus griseus (Chinese hamster)	1975	384/744 (51%)	520/744 (69%)	8.0e-204
Q9Z1B4	PHOSPHOLIPASE C DELTA-1 - Mus musculus (Mouse)	1941	388/744 (52%)	511/744 (68%)	3.2e-200
P51178	1-phosphatidylinositol- 4,5-bisphosphate phosphodiesterase delta 1 (EC 3.1.4.11) (PLC- delta-1) (Phospholipase C-delta-1) (PLC-III) - Homo sapiens (Human)	1937	381/744 (51%)	509/744 (68%)	8.5e-200

A multiple sequence alignment is given in Table 6D in a ClustalW analysis comparing NOV6 with related protein sequences disclosed in Table 6C.

5

**TABLE 6D. CLUSTALW ANALYSIS OF NOV6**

	1. SEQ ID NO.: 12	NOV6	4. SEQ ID NO.: 116	Q60450
	2. SEQ ID NO.: 114	CAC88658	5. SEQ ID NO.: 117	Q9Z1B4
	3. SEQ ID NO.: 115	Q96FL6	6. SEQ ID NO.: 118	P51178
10				
		10 20 30 40 50 60		
	NOV6	.....MGLTEDEVDVRAMLRGSRLRKIRSRITWHKERLYRLQEDGLSVWFQRR--IPR	49	
	CAC88658	.....MGLTEDEVDVRAMLRGSRLRKIRSRITWHKERLYRLQEDGLSVWFQRR--IPR	49	
15	Q96FL6	.....GLQDDQDLCALLKGSOLLKVKSSWRRERFYKLOEDCKTIWQESRKVMR	1	
	Q60450	MDSGRDFLTLLHGLQDDPDLCALLKGSOLLKVKSSWRRERFYKLOEDCKTIWQESRKVMR	49	
	Q9Z1B4	MDSGRDFLTLLHGLQDDPDLCALLKGSOLLKVKSSWRRERFYKLOEDCKTIWQESRKVMR	60	
	P51178	MDSGRDFLTLLHGLQDDPDLCALLKGSOLLKVKSSWRRERFYKLOEDCKTIWQESRKVMR	60	
20		70 80 90 100 110 120		
	NOV6	APSQHLEFFVQHIEAVREGHSEGLRRFFGGAFAPARCLITAFKGRKNLDLAAPTAEEAQR	109	
	CAC88658	APSQHLEFFVQHIEAVREGHSEGLRRFFGGAFAPARCLITAFKGRKNLDLAAPTAEEAQR	109	
25	Q96FL6	.....SPESQLFSIEDIQEVRMGHRTGLEKGFARDIPEDRCFSIVFKDORNTLDLIAPSSADAQH	1	
	Q60450	SPESQLFSIEDIQEVRMGHRTGLEKGFARDIPEDRCFSIVFKDORNTLDLIAPSPADVQH	109	
	Q9Z1B4	SPESQLFSIEDIQEVRMGHRTGLEKGFARDIPEDRCFSIVFKDORNTLDLIAPSPADVQH	120	
	P51178	TPESQLFSIEDIQEVRMGHRTGLEKGFARDVPEPDRCFISIVFKDORNTLDLIAPSPADAQH	120	
30		130 140 150 160 170 180		
	NOV6	WVRGLTKLRARLDAMSQRERLDQWIHSYLHRADSNODSKMSFKEIKSLRMVNVDMNDMY	169	
	CAC88658	WVRGLTKLRARLDAMSQRERLDQWIHSYLHRADSNODSKMSFKEIKSLRMVNVDMNDMY	169	
	Q96FL6	.....MSQRERLDQWIHSYLHRADSNODSKMSFKEIKSLRMVNVDMNDMY	46	
	Q60450	WVOGLRKTIHHSMSMDQROKLOHWHISCLRKADKNKDNKMNFKELKDFLKEINLQVDDSY	169	
35	Q9Z1B4	WVOGLRKTIHHSMSMDQROKLOHWHISCLRKADKNKDNKMNFKELKDFLKEINLQVDDSY	180	
	P51178	WVLGLHKTIHHSMSMDQROKLOHWHISCLRKADKNKDNKMSFKELQNFLEINLQVDDSY	180	
40		190 200 210 220 230 240		
	NOV6	AYLIFKECDHSNNDRLLEGAEIEEELRLRLKRPLEELFHOYSGEDRVLSAPELLEFLEDQ	229	

5	CAC88658	AYLLFKECDHSNNDRLEGAIEIEFLRRLLKRPELEETIFHOYSGEDRVLSAPELLEFLFLEDC	229
	Q96FL6	AYLLFKECDHSNNDRLEGAIEIEFLRRLLKRPELEETIFHOYSGEDRVLSAPELLEFLFLEDC	106
	Q60450	ARKLFRECDHSQTDLSLEDEEIEITFYKMLTORAEIDRVFAAAGSAETLSVEKLVTFLOHC	229
	Q9Z1B4	ARKLFRECDHSQTDLSLEDEEIEITFYRMLTORAEIDRAFAAAGSAETLSVEKLVTFLOHC	240
	P51178	ARKLFRECDHSQTDLSLEDEEIEAFYKMLTORVEIDRTFAAAGPGETLSVDOLVTFLOHC	240
10		250 260 270 280 290 300	
	NOV6	..... ..... ..... ..... ..... .....	
	CAC88658	-GEEGATLARAQQLIQTVELNETAPAAKQHELMTLDGFM MYLLSPEGAALDNTHTCVFQD	288
	Q96FL6	-GEEGATLARAQQLIQTVELNETA---KQHELMTLDGFM MYLLSPEGAALDNTHTCVFQD	162
	Q60450	QREEAAGPALALS LIERYEPSETA---KAQROMTKDGF MYLLSADGSAFSLAHRRVYQD	286
15	Q9Z1B4	QREEAAGPALALS LIERYEPSETA---KAQROMTKDGF MYLLSADGNAFSLAHRRVYQD	297
	P51178	QREEAAGPALALS LIERYEPSETT---KAQROMTKDGF MYLLSADGSAFSLAHRRVYQD	297
20		310 320 330 340 350 360	
	NOV6	..... ..... ..... ..... ..... .....	
	CAC88658	MNQPLAHYFTSSSHNTYLTDSQIGGPSSTEAYVRAFAQGCRCVELDCWEGPGGEPVIYHG	345
	Q96FL6	MNQPLAHYFTSSSHNTYLTDSQIGGPSSTEAYVRAFAQGCRCVELDCWEGPGGEPVIYHG	222
	Q60450	MQPLSHYLVSSSHNTYLLDQITGPSSTEAYTRALCKGCRCVELDCWEGPNQEPVIYHG	346
25	Q9Z1B4	MNQPLSHYLVSSSHNTYLLDQITGPSSTEAYTRALCKGCRCVELDCWEGPNQEPVIYHG	357
	P51178	MGQPLSHYLVSSSHNTYLLDQIAGPSSTEAYTRALCKGCRCVELDCWEGPNQEPVIYHG	357
30		370 380 390 400 410 420	
	NOV6	..... ..... ..... ..... ..... .....	
	CAC88658	HTLTSKILFRDVVOAVRDHAFITVSPYPVILSLENHCGLEQQAAMARHLCTILGDMLYTQA	405
	Q96FL6	HTLTSKILFRDVVOAVRDHAFITVSPYPVILSLENHCGLEQQAAMARHLCTILGDMLYTQA	282
	Q60450	YTFTSKILFYDVLRAIRDYAFKASYPVILSLENHCSLEQQQVMARHLKAILGPMLLDQP	406
35	Q9Z1B4	YTFTSKILFCDVLRAIRDYAFKASYPVILSLENHCSLEQQQVMARHLKAILGPMLLDQP	417
	P51178	YTFTSKILFCDVLRAIRDYAFKASYPVILSLENHCTLEQQQVMARHLKAILGPMLLNRP	417
40		430 440 450 460 470 480	
	NOV6	..... ..... ..... ..... ..... .....	
	CAC88658	LDSPNPEELPSPEQLKGRVLVKGKKLP---AARSEDCRALSDREEEEEEDDEEEEEVEEAA	462
	Q96FL6	LDSPNPEELPSPEQLKGRVLVKGKKLP---AARSEDCRALSDREEEEEEDDEEEEEVEEAA	339
	Q60450	LDG-VTMSLPSPPEQLKGGKLLKGKKFGGLLPAGGENGPETIDVSDDEEAAEMDEEAVRSQ	465
45	Q9Z1B4	LDG-VTTSLPSPPEQLKGGKLLKGKKFGGLLPAGGENGPETIDVSDDEEAAEMDEEAVRSQ	476
	P51178	LDG-VTNSLPSPPEQLKGGKLLKGKKFGGLLPAGGEGCPEATVVSDDEEAAEMDEEAVRSR	476
50		490 500 510 520 530 540	
	NOV6	..... ..... ..... ..... ..... .....	
	CAC88658	AQR-----QTSPELSALAVYCHATRLRPDTSFGGLGSQVVRGERFPDRNRLLKAWG	518
	Q96FL6	AQRRLAK---QTSPELSALAVYCHATRLR-TLHPAPNAPQPCQVSSLSERKAKKLIREAG	395
	Q60450	VQOKSKEDKLNVAPELSDMVIYCKSVHFGGFSNPSTSGQAFYEMASFSENRALRLLOESG	525
55	Q9Z1B4	VQHKPKEDKLVPELSDMVIYCKSVHFGGFSNPSTSGQAFYEMASFSERALRLLOESG	536
	P51178	VQHKPKEDKLRLAQELSDMVIYCKSVHFGGFSNPSTSGQAFYEMASFSENRALRLLOESG	536
60		550 560 570 580 590 600	
	NOV6	..... ..... ..... ..... ..... .....	
	CAC88658	NSFVRHNNARQLTRVYPLGLRMNSANYSPQEMWNSGCQVALNFQTPGYEMDNAGRFLVN	578
	Q96FL6	NSFVRHNNARQLTRVYPLGLRMNSANYSPQEMWNSGCQVALNFQTPGYEMDNAGRFLVN	455
	Q60450	NNFVRHNVSHLSRIYPACRRITSSNYSPVEMWNGGCQVALNFQTPGPPEMDVYLGRFQDN	585
65	Q9Z1B4	NSFVRHNVGHLRIYPACWRITSSNYSPVEMWNGGCQVALNFQTPGPPEMDVYLCGFQDN	596
	P51178	NGFVRHNVGHLRIYPACWRITSSNYSPVEMWNGGCQVALNFQTPGPPEMDVYQDRFQDN	596
70		610 620 630 640 650 660	
	NOV6	..... ..... ..... ..... ..... .....	
		GCGGYVLKPACLRQPDSTFDP---HYFGPPRTTLLSIQVLAQQLPKNAEKPEISIVDPL	634

5

```

CAC88658  GQCGYVLKPACLRQPDSTFDP----EYPGPPRTTLSIQVLTAAQQLPKLNAEKPHSIVDEL 634
Q96FL6    GQCGYVLKPACLRQPDSTFDP----EYPGPPRTTLSIQVLTAAQQLPKLNAEKPHSIVDEL 511
Q60450    GACGYVLKPAFLRDPDIAFNRLALTOGPWWAQKRLRVRVISGQQLPKVKNKSK-NSIVDPK 644
Q9Z1B4    GCGYVLKPAFLRDPDITFNSRALTOGPWWAPKKLRVWIIISGQQLPKVKNKKNK-NSIVDPK 655
P51178    GACGYVLKPAFLRDPDNGTFNRLALAGGPWWAKRLNIRVVISGQQLPKVKNKKNK-NSIVDPK 655

```

10

```

NOV6       VRTEIHGVPADCARQETDYVLNNGFNPRWGQTLOFQIRAPELALVRFVVEDYDATSPNDF 694
CAC88658   VRTEIHGVPADCARQETDYVLNNGFNPRWGQTLOFQIRAPELALVRFVVEDYDATSPNDF 694
Q96FL6     VRTEIHGVPADCARQETDYVLNNGFNPRWGQTLOFQIRAPELALVRFVVEDYDATSPNDF 571
Q60450     VIVEVHGVGQDVASRCTAVITNNGFNPRWDTFEFEVAVPDLALVRFVVEDYDASSKNDF 704
Q9Z1B4     VIVEIHGVGQDVASRCTAVITNNGFNPRWDTFEFEVAVPDLALVRFVVEDYDASSKNDF 715
P51178     VTVEIHGVSRDVASRCTAVITNNGFNPRWDTFEFAFEVVPDLALVRFVVEDYDASSKNDF 715

```

15

```

NOV6       VGOFTPLSSLKQGYRHVHLLSKDGASLSPATLFTQIRIORS 736
CAC88658   VGOFTPLSSLKQGYRHVHLLSKDGASLSPATLFTQIRIORS 736
Q96FL6     VGOFTPLSSLKQGYRHVHLLSKDGASLSPATLFTQIRIORS 613
Q60450     IGQSTLPWNSLKQGYRHVHLLSKNGDQHPSATLFTVKISIQD- 745
Q9Z1B4     IGQSTLPWNSLKQGYRHVHLLSKNGDLHPSATLFTVKISIQD- 756
P51178     IGQSTLPNLSLKQGYRHVHLLSKNGDQHPSATLFTVKISIQD- 756

```

20

25 Additional BLASTP results are shown in Table 6E.

Table 6E. Patp BLASTP Analysis for NOV6					
Sequences producing High-scoring Segment Pairs	Protein/ Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAG63220	Amino acid sequence of a human lipid metabolism enzyme	789	707/736 (96%)	713/736 (96%)	0.0
patp:AAB47516	Human phospholipase C, 16835	736	707/736 (96%)	713/736 (96%)	0.0
patp:AAV81394	Rat phospholipase C-delta-1	756	382/744 (51%)	509/744 (68%)	2.2e-199
patp:AAW01596	Inositol-1,4,5-triphosphate binding protein	1096	260/733 (35%)	380/733 (51%)	1.1e-105
patp:AAR90583	Phospholipase C-gamma-1	1290	149/392 (38%)	220/392 (56%)	3.3e-105

30 Domain results for NOV6 were collected from the Pfam database, and then identified by the Interpro domain accession number. The results are listed in Table 6F with the statistics and domain description. These results indicate that the NOV6 polypeptide has properties similar to those of other proteins known to contain these domains.

TABLE 6F. DOMAIN ANALYSIS OF NOV6		
PSSMs Producing Significant Alignments	Score (bits)	E Value





NOV6 nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications and as a research tool. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from: Von Hippel-Lindau (VHL) syndrome, Alzheimer's disease, stroke, tuberous sclerosis, hypercalcaemia, Parkinson's disease, Huntington's disease, cerebral palsy, epilepsy, Lesch-Nyhan syndrome, multiple sclerosis, ataxia-telangiectasia, leukodystrophies, behavioral disorders, addiction, anxiety, pain, neuroprotection, hemophilia, hypercoagulation, idiopathic thrombocytopenic purpura, immunodeficiencies, graft versus host disease, lymphedema, allergies and other diseases, disorders and conditions of the like.

The novel NOV6 nucleic acids and polypeptides of the invention, or fragments thereof, are useful in diagnostic applications, wherein the presence or amount of the nucleic acid or the protein are to be assessed. These materials are further useful in the generation of antibodies that bind immunospecifically to the novel substances of the invention for use in therapeutic or diagnostic methods. These antibodies may be generated according to methods known to one ordinarily skilled in the art, using prediction from hydrophobicity charts, as described in the "Anti-NOVX Antibodies" section below.

The disclosed NOV6 protein of the invention has multiple hydrophilic regions, each of which can be used as an immunogen. The NOV6 protein also has value in the development of a powerful assay system for functional analysis of various human disorders, which will help in understanding of pathology of the disease and development of new drug targets for various disorders.

Phosphoinositide-specific phospholipase C (PLC) subtypes comprise a related group of multidomain phosphodiesterases that cleave the polar head groups from inositol lipids. Activated by all classes of cell surface receptors, these enzymes generate the ubiquitous second messengers inositol 1,4, 5-trisphosphate and diacylglycerol. The former provokes a transient increase in intracellular free  $\text{Ca}^{2+}$ , while the latter serves as a direct activator of protein kinase C. Increase in intracellular  $\text{Ca}^{2+}$  level and activated protein kinase C will further activate distinct signal transduction pathways, which induce various biological responses, e.g., cell proliferation and the immune response. Therefore, phospholipases are important membrane bound enzymes that may potentially serve as therapeutic drug targets.

## NOV7

The NOV7 nucleic acid (SEQ ID NO:13) (alternatively referred to as CG55802-01) of 1059 nucleotides encodes a novel 3 alpha-hydroxy steroid dehydrogenase-like protein and is

shown in Table 7A. An open reading frame for the mature protein was identified beginning with a ATG initiation codon at nucleotides 31-33 and ending with a TAA codon at nucleotides 1000-1002. Putative untranslated regions upstream from the start codon and downstream from the termination codon are underlined in Table 7A. The start and stop codons are in bold letters.

Table 7A. NOV7 Nucleotide Sequence (SEQ ID NO:13)	
AAACATTTGCTAACCAGGCCAGTGACAGAAATGGATTGCGAAATACCAGTGTGTGAAGCTGAATGATGGTCACTTCA	TGCCTGTCCTGGGATTTGGCACCTATGCGCCTGCAGAGGTACCTAAAAGTAAAGCTCTAGAGGCCGCTCAAATTGGC
AATAGAAGCCGGGTTCCACCATATTGATTCTGCACATGTTTACAATAATGAGGAGCAGGTTGGACTGGCCATCCGA	AGCAAGATTGCAGATGGCAGTGTGAAGAGAGAAGACATATTCTACACTTCAAAGCTTTGGAGCAATCCCATCGAC
CAGAGTTGGTCCGACCAGCCTTGGAAAGGTCACTGAAAAATCTTCAATTGGACTATGTTGACCTCTATCTTATTCA	TTTTCCAGTGTCTGTAAAGCCAGGTGAGGAAGTGATCCCAAAAGATGAAAAATGAAAAATACTATTGACACAGTG
GATCTCTGTGCCACATGGAAGGCCCTGGAGAAATGCAGAGATGCAGGTTTAACCAGGTCCATCAGGGTGTCCAGTT	TCAATCACAAGCTGCTGGAACCTCATCCTCAACAAGCCAGGGCTCAGGTACAAGCCACCTGCAACCAGGTGGAATG
TCACCTTTACCTCAACCAGAGCAAACCTCCTGGAGTTCTGCAAGTCCAAGGACATTGTTCTAGTTGCCTACAGTGCC	CTGGGATCCCAAAGAGAGCCACAGTGGGTGGATCCCGACTGCCCCACATCTCTTGGAGGAGCCGATCTTGAAATCCA
TTGCCAAGAAACACAGTGAAGCCAGGCCAGGTGCGCCTGCGCTACCAGCTGCAGCGGGGAGTGGTGGTGTGGC	CAAGAGCTTCTCTCAGGAGAGAATCAAAGAGAACTCCAGGTATTTGACTTTGAGTTGACTCCAGAGGACATGAAA
GCCATTGATGGCCTCAACAGAAATCTCGATATCTTTCTTTCTTCAGTCTTGCTGGACACCCTGATTATCCATTTT	CAGACAAATATTAAATGAGGAGCTTTGCGTGAGTTCTACCAGAGGCCCTGTGTGTAGATGGTGACACAGA

The NOV7 of the invention maps to chromosomes 10.

In a search of sequence databases, it was found, for example, that the NOV7 nucleic acid sequence of this invention has 940 of 1053 bases (89%) identical to a gb:GENBANK-ID:HSU05598|acc:U05598.1 mRNA from Homo sapiens (Human dihydrodiol dehydrogenase mRNA, complete cds).

The NOV7 polypeptide (SEQ ID NO:14) encoded by SEQ ID NO:13 is 323 amino acid residues in length and is presented using the one-letter amino acid code in Table 7B. The SignalP, Psort and/or Hydropathy results predict that NOV7 has no known signal peptide and is likely to be localized in the cytoplasm with a certainty of 0.4500. In alternative embodiments, a NOV7 polypeptide is located to the microbody (peroxisome) with a certainty of 0.3000, the mitochondrial matrix space with a certainty of 0.1000, or the lysosome (lumen) with a certainty of 0.1000.

Table 7B. Encoded NOV7 Protein Sequence (SEQ ID NO:14)	
MDSKYQCVKLNLDGHFMPVLGFGTYAPAEVPSKALEAVKLAIEAGFHHIDSAHVYNNEEQVGLAIRSKIADGSVK	REDIFYTSKLWSNSHRPELVRPALERSLKNLQLDYVDLYLIHFVPVSVKPGEEVIPPDKENGKILFDTVDLCATWKA
LEKCRDAGLTRSIRVSSFNKKLLELILNKPGLRYKPTCNQVECHPYLNQSKLLEFCKSKDIVLVAYSALGSQRDP	QWVDPDCPHLLEPIPKSIKKHSRSPGQVALRYQLQRGVVVLAKSFSQERIKENFQVDFELTPEDMKAIIDGLN
RNLRYLSFFSLAGHPDYPFSDKY	

The full amino acid sequence of the NOV7 protein of the invention has 272 of 323 amino acid residues (84%) identical to, and 302 of 323 amino acid residues (93%) similar to,

the 323 amino acid residue ptnr:TREMBLNEW-ACC:BAA36169 protein from Homo sapiens (Human) (DD2/BILE ACID-BINDING PROTEIN/AKR1C2/3ALPHA-HYDROXYSTEROID DEHYDROGENASE TYPE 3).

The amino acid sequence of NOV7 has high homology to other proteins as shown in

5 Table 7C.

Table 7C. NOV7 BLASTP Results					
Gene Index/ Identifier	Protein/Organism	Length of aa	Identity (%)	Positives (%)	Expect Value
Q96A71	ALDO-KETO REDUCTASE FAMILY 1, MEMBER C2 (DIHYDRODIOL DEHYDROGENASE 2, BILE ACID BINDING PROTEIN, 3-ALPHA HYDROXYSTEROID DEHYDROGENASE, TYPE III) (DD2/BILE ACID-BINDING PROTEIN/AKR1C2/3ALPHA-HYDROXYSTEROID DEHYDROGENASE TYPE 3) - Homo sapiens (Human)	1467	272/323 (84%)	302/323 (93%)	5.4e-150
P52895	Probable trans-1,2-dihydrobenzene-1,2-diol dehydrogenase (EC 1.3.1.20) (Chlordecone reductase homolog HAKRD) (Dihydrodiol dehydrogenase/bile acid-binding protein) (DD/BABP) - Homo sapiens (Human)	1453	269/323 (83%)	301/323 (93%)	1.7e-148
Q04828	Trans-1,2-dihydrobenzene-1,2-diol dehydrogenase (EC 1.3.1.20) (High-affinity hepatic bile acid-binding protein) (HBAB) (Chlordecone reductase homolog HAKRC) (Dihydrodiol dehydrogenase 2) (DD2) (20 alpha-hydroxysteroid dehydrogenase) - Homo sapiens (Human)	1432	266/323 (82%)	297/323 (91%)	2.8e-146
I53872	dihydrodiol dehydrogenase (EC 1.1.1.-) - human	1403	259/307 (84%)	290/307 (94%)	3.3e-143
Q95JH6	3 (20) ALPHA-HYDROXYSTEROID/DIHYDRODIOL/INDANOL DEHYDROGENASE (EC 1.1.1.112) - Macaca fuscata (Japanese macaque)	1398	257/323 (79%)	295/323 (91%)	1.1e-142

A multiple sequence alignment is given in Table 7D in a ClustalW analysis comparing NOV7 with related protein sequences disclosed in Table 7C.

10

TABLE 7D. CLUSTALW ANALYSIS OF NOV7

1. SEQ ID NO.: 14	NOV7	4. SEQ ID NO.: 124	Q04828
2. SEQ ID NO.: 122	Q96A71	5. SEQ ID NO.: 125	I53872
3. SEQ ID NO.: 123	P52895	6. SEQ ID NO.: 126	Q95JH6

15

10 20 30 40 50 60

NOV7 MDSKYQCCKLNDGHFMPVLGFGTYAPAEVPSKALEAVKLAIEAGFHHDIDSAHVYNNEEQ 60  
 Q96A71 MDSKYQCCKLNDGHFMPVLGFGTYAPAEVPSKALEAVKLAIEAGFHHDIDSAHVYNNEEQ 60  
 P52895 MDSKYQCCKLNDGHFMPVLGFGTYAPAEVPSKALEAVKLAIEAGFHHDIDSAHVYNNEEQ 60  
 Q04828 MDSKYQCCKLNDGHFMPVLGFGTYAPAEVPSKALEAVKLAIEAGFHHDIDSAHVYNNEEQ 60  
 I53872 MDSKYQCCKLNDGHFMPVLGFGTYAPAEVPSKALEAVKLAIEAGFHHDIDSAHVYNNEEQ 60  
 Q95JH6 MDSKYQCCKLNDGHFMPVLGFGTYAPAEVPSKALEAVKLAIEAGFHHDIDSAHVYNNEEQ 60

70 80 90 100 110 120  
 NOV7 VGLAIRSKIADGSVKREDIFYTSKLWSNSHRPELVLPALERSLKNLQLDYVDLYLIHFPV 120  
 Q96A71 VGLAIRSKIADGSVKREDIFYTSKLWSNSHRPELVLPALERSLKNLQLDYVDLYLIHFPV 120  
 P52895 VGLAIRSKIADGSVKREDIFYTSKLWSNSHRPELVLPALERSLKNLQLDYVDLYLIHFPV 120  
 Q04828 VGLAIRSKIADGSVKREDIFYTSKLWSNSHRPELVLPALERSLKNLQLDYVDLYLIHFPV 120  
 I53872 VGLAIRSKIADGSVKREDIFYTSKLWSNSHRPELVLPALERSLKNLQLDYVDLYLIHFPV 120  
 Q95JH6 VGLAIRSKIADGSVKREDIFYTSKLWSNSHRPELVLPALERSLKNLQLDYVDLYLIHFPV 120

130 140 150 160 170 180  
 NOV7 SVKPGEEVIPKDENGKILFDTVDLCATWEAMEKCKDAGLAKSIGVSNFNHRLLEMLILNKP 180  
 Q96A71 SVKPGEEVIPKDENGKILFDTVDLCATWEAMEKCKDAGLAKSIGVSNFNHRLLEMLILNKP 180  
 P52895 SVKPGEEVIPKDENGKILFDTVDLCATWEAMEKCKDAGLAKSIGVSNFNHRLLEMLILNKP 180  
 Q04828 SVKPGEEVIPKDENGKILFDTVDLCATWEAMEKCKDAGLAKSIGVSNFNHRLLEMLILNKP 180  
 I53872 SVKPGEEVIPKDENGKILFDTVDLCATWEAMEKCKDAGLAKSIGVSNFNHRLLEMLILNKP 180  
 Q95JH6 SVKPGEEVIPKDENGKILFDTVDLCATWEAMEKCKDAGLAKSIGVSNFNHRLLEMLILNKP 180

190 200 210 220 230 240  
 NOV7 GLKYKPVNCQVECHPYFNQKRLDFCKSKDIVLVAYSALGSHREEPWVDPNSPVLLLEDPV 240  
 Q96A71 GLKYKPVNCQVECHPYFNQKRLDFCKSKDIVLVAYSALGSHREEPWVDPNSPVLLLEDPV 240  
 P52895 GLKYKPVNCQVECHPYFNQKRLDFCKSKDIVLVAYSALGSHREEPWVDPNSPVLLLEDPV 240  
 Q04828 GLKYKPVNCQVECHPYFNQKRLDFCKSKDIVLVAYSALGSHREEPWVDPNSPVLLLEDPV 240  
 I53872 GLKYKPVNCQVECHPYFNQKRLDFCKSKDIVLVAYSALGSHREEPWVDPNSPVLLLEDPV 240  
 Q95JH6 GLKYKPVNCQVECHPYFNQKRLDFCKSKDIVLVAYSALGSHREEPWVDPNSPVLLLEDPV 240

250 260 270 280 290 300  
 NOV7 LKSTAKKHSRSPGOVALRYQLQRGVVVLAKSYNEQRIQNVQVFEFQLTSEEMKAIDGLN 300  
 Q96A71 LKSTAKKHSRSPGOVALRYQLQRGVVVLAKSYNEQRIQNVQVFEFQLTSEEMKAIDGLN 300  
 P52895 LKSTAKKHSRSPGOVALRYQLQRGVVVLAKSYNEQRIQNVQVFEFQLTSEEMKAIDGLN 300  
 Q04828 LKSTAKKHSRSPGOVALRYQLQRGVVVLAKSYNEQRIQNVQVFEFQLTSEEMKAIDGLN 300  
 I53872 LKSTAKKHSRSPGOVALRYQLQRGVVVLAKSYNEQRIQNVQVFEFQLTSEEMKAIDGLN 300  
 Q95JH6 LKSTAKKHSRSPGOVALRYQLQRGVVVLAKSYNEQRIQNVQVFEFQLTSEEMKAIDGLN 300

310 320  
 NOV7 RNVRYLTLDIFAGPPNYP---FSDEY-- 323  
 Q96A71 RNVRYLTLDIFAGPPNYP---FSDEY-- 323  
 P52895 RNVRYLTLDIFAGPPNYP---FSDEY-- 323  
 Q04828 RNVRYLTLDIFAGPPNYP---FSDEY-- 323  
 I53872 RNVRYLTLDIFAGPPNYP---FSDEY-- 323  
 Q95JH6 RNVRYLTLDIFAGPPNYP---FSDEY-- 323

Additional BLASTP results are shown in Table 7E.

55

Table 7E. Patp BLASTP Analysis for NOV7					
Sequences producing High- scoring Segment Pairs	Protein/ Organism	Length (aa)	Identity (%)	Positive (%)	E Value

patp:AAB43444	Human cancer associated protein sequence	336	266/323 (82%)	296/323 (91%)	5.7e-146
patp:AAW14799	Type 5 17-beta-hydroxysteroid dehydrogenase - Homo sapiens	323	249/323 (77%)	287/323 (88%)	1.5e-138
patp:AAM78471	Human protein No. 1133	323	249/323 (77%)	287/323 (88%)	1.5e-138
patp:AAM79455	Human protein No. 3101	325	249/323 (77%)	287/323 (88%)	1.5e-138
patp:AAV41041	Human lung tumor antigen L773P	364	244/295 (82%)	274/295 (92%)	1.4e-133

- Domain results for NOV7 were collected from the Pfam database, and then identified by the Interpro domain accession number. The results are listed in Table 7F with the statistics and domain description. These results indicate that the NOV7 polypeptide has properties similar to those of other proteins known to contain these domains.

TABLE 7F. DOMAIN ANALYSIS OF NOV7		
PSSMs Producing Significant Alignments	Score (bits)	E Value
aldo_ket_red: domain 1 of 1, from 10 to 303	502.7	5.7e-149
<div> <div>(SEQ ID NO:127)</div> <div> LnnG1klkmP1lG1GtwqtpgeedylwgrvdkeeakeavkaAldaGY   + + +  +  + + + +   +           ++ + NOV7 LNDGH--FMPVLGFGTYAPAE-----VPSKALEAVKLAIEAGF </div> </div> <div> <div>RhiDtAaiYgNGqkPgqSEeevGeaikealeegsvvvitkykRediFits</div> <div>     ++ +    + +  ++++++            +  HHIDSAHVYNN-----EEQVGLAIRSKIADGSV-----KREDIFYTS </div> </div> <div> <div>dKlwnftfgpDlseyghspkhvrealSLkrLgDyVdLyLiHwPdpfkp</div> <div>     ++   + ++ +       + +            + ++    -KLWSNS-----HRPELVRPALERSLKNLQLDYVDLYLIHFPVSVKP </div> </div> <div> <div>giedkyp1gfpdtdgklyedvpieetWkAleklvdeGkvrsIGVSNfs</div> <div>   + + + ++  +++++ ++++          ++ + ++      + + G-EEV----IPKDENGKILFDTVDLCATWKALEKCRDAGLTRSIRVSSFN </div> </div> <div> <div>aeqleellsyagklklipPvvvQvElHPylrqdelrkvPLLPfCkshGIa</div> <div> ++    + +++  + ++ ++          +  + ++       ++ + HKLLELILNKPG-LR-YKPTCNQVECHPYLNQSKLLE-----FCKSKDIV </div> </div> <div> <div>vtAySPLgsG1LtGkykteedipgdrsrllgadkgwselgspelledpvl</div> <div> ++       ++   + ++++       + +  LVAYSALGSQR-----DPQWVDPDCPHLLEEPIL </div> </div> <div> <div>kaiAekygykdktpAQvaLrWalqrGgGagvvvIPKSSnpeRikeNlka</div> <div>     + + ++          ++          ++ ++           ++ KSIKKHS---RSPGQVALRYQLQRG-----VVVLAKSFSQERIKENFQV </div> </div> <div> <div>fddfeLteedmkaideldrgk</div> <div>           +          +  + + </div> </div>		

The NOV7 nucleic acids and polypeptides disclosed in this invention are expressed in at least the following tissues: liver/spleen (pool), and gall bladder. This information was derived by determining the tissue sources of the sequences that were included in the invention including but not limited to SeqCalling sources, Public EST sources, Literature sources, and/or RACE sources.

The protein similarity information, expression pattern, and map location for the NOV7 protein and nucleic acid disclosed herein suggest that this protein may have important structural and/or physiological functions characteristic of the aldo-keto reductase family.

Therefore, the NOV7 nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications and as a research tool. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from: cancer, trauma, regeneration (in vitro and in vivo), viral/bacterial/parasitic infections, Von Hippel-Lindau (VHL) syndrome, cirrhosis, transplantation and other diseases, disorders and conditions of the like.

The novel NOV7 nucleic acids and polypeptides of the invention, or fragments thereof, are useful in diagnostic applications, wherein the presence or amount of the nucleic acid or the protein are to be assessed. These materials are further useful in the generation of antibodies that bind immunospecifically to the novel substances of the invention for use in therapeutic or diagnostic methods. These antibodies may be generated according to methods known to one ordinarily skilled in the art, using prediction from hydrophobicity charts, as described in the "Anti-NOVX Antibodies" section below.

The disclosed NOV7 protein of the invention has multiple hydrophilic regions, each of which can be used as an immunogen. The NOV7 protein also has value in the development of a powerful assay system for functional analysis of various human disorders, which will help in understanding of pathology of the disease and development of new drug targets for various disorders.

The aldo-keto reductase family includes a number of related monomeric NADPH-dependent oxidoreductases, such as aldose reductase, prostaglandin F synthase, xylose reductase, aldehyde reductases, hydroxysteroid dehydrogenases, dihydrodiol dehydrogenases and many others. All possess a similar structure, with a beta-alpha-beta fold characteristic of nucleotide binding proteins. The fold comprises a parallel beta-8/alpha-8-barrel, which contains a novel NADP-binding motif. The (alpha/beta) 8-barrel fold provides a common scaffold for an NAD(P)(H)-dependent catalytic activity, with substrate specificity determined by variation of loops on the C-terminal side of the barrel. All the aldo-keto reductases are dependent on nicotinamide cofactors for catalysis and retain a similar cofactor binding site, even among proteins with less than 30% amino acid sequence identity. Members of members of the aldo-keto reductase (AKR), short-chain dehydrogenases/reductases (SDR) and quinone reductase (QR) superfamilies are involved in reductive pathways involved in synthesis and disposition of carbonyl and hydroxyl group containing compounds.

## NOV8

A disclosed NOV8 nucleic acid (SEQ ID NO:15) of 879 nucleotides (also referred to as CG55904-01) encoding a novel Squalene Desaturase-like protein is shown in Table 8A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 24-26 and ending with a TGA codon at nucleotides 861-863. Putative untranslated regions are found upstream from the initiation codon and downstream from the termination codon, and are underlined. The start and stop codons are shown in bold letters in Table 8A.

**Table 8A. NOV8 nucleotide sequence (SEQ ID NO:15).**

ATTATACTATTGTCACAATATAATGAAAGAACATTCAAAAACGTTCTCATATGCCTTTGATTTT
TTGGATTTAAAAAGGAAAAAGCAATTTGGGCTATTTATGCAGTTTGCAGAATTATAGATGACAG
TATTGATAAATACAAAGACCTTGAGCAATTAAACGGCATAGCTAGAGATTTAGATGTGATTTATA
GCGATTGTGATTATATTCAAGCCTATCAAAGTGATGCAGCTATTATGAATGCTTTAAGTAATACA
TTGAATACATATTCAATACCTAAAAAACCTTTGAATCTTTAATTCAATATGTGAAGGAAGATTT
AGTTTAAAAAGAAATGAAAACCTGATTGAGATTTATATGAGTATTGCTATGGTGTGGTAGGTACTG
TGGTGAATTTGTTAACTCCTATATTAACCTCATCAAATGAAAATAATTTTCGAGCAAGCTGAAGAA
GCTGCGATTGCTTTAGGCAAGGCAATGCAAATACTAATATTTTAAGAGATGTGCGCGAAGATTT
TCAAAATGGAAGAATTTATCTAAGTGTTGAAAAATTAGCTCAATATCGAGTTAATCTACATTCTA
TATATTATGAAGGAGTTTCGCCAAATTATATAGAAGTGTGGGAAAGTTACGCTACAGAGACAGTT
AGGTATATGATATTGCATTAAACGGTATTAATTATTTTGACGAAGAGGTACGTTACATTATCGA
ATTAGCTGCGATAGCTTATCATGAAATACTTGTGGAAGTAAGGAAGGCAAACTATACGTTGCATA
AGAAAGTATATGTAAGCAAATTGAAAAAATGAAAATTTATCGTGAACCTTAGTGCGAAATATAAT
AGGAGTGAAACATTATGAAGATTGCAGTTATAGG

NOV8 CG55904-01 genomic clones map to chromosome 5.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 532 of 879 bases (60%) identical to a gb:GenBank-ID:SAP1P2| acc:X73889.1 mRNA from genes crtM and crtN from *S. aureus*.

A disclosed NOV8 polypeptide (SEQ ID NO:16) encoded by SEQ ID NO:15 has 279 amino acid residues and is presented in Table 8B using the one-letter amino acid code.

SignalP, Psort and/or Hydropathy results predict that NOV8 does not possess a signal peptide and is likely to be localized to the cytoplasm with a certainty of 0.3000. NOV8 has a

molecular weight of 32387.5 Daltons.

**Table 8B. Encoded NOV8 protein sequence (SEQ ID NO:16).**

MKEHSTKFSYAFDFDLKRRKAIWAIYAVCRIIDDSIDKYKDLEQLNGIARDLDVIYSDCDYI  
QAYQSDAAIMNALSNTLNTYSIPKKPFESLIQYVKEDLVLKEMKTDSLDYCYGVVGTGEL  
LTPILTSSNENNFEQAEEAAIALGKAMQITNILRDVGEDFQNGRIYLSVEKLAQYRVNLHSIY  
YEGVSPNYIELWESYATETVRLYDIALNGINYFDEEVRYIIELAAIAYHEILVEVRKANYTLH  
KKVYVSKLKKMKIYRELSAKYNRSETL

The full amino acid sequence of the protein of the invention was found to have 133 of 275 amino acid residues (48%) identical to, and 183 of 275 amino acid residues (66%) similar to, the 287 amino acid residue ptmr:SptrEmbl-ACC:Q99R75 Squalene Desaturase protein from *S. aureus*.

In a further search of public sequence databases, NOV8 was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 8C.

**Table 8C. BLASTP results for NOV8**

Gene Index/ Identifier	Protein/ Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptmr:SPTREMBL- ACC:Q99R75	SQUALENE DESATURASE - Staphylococcus aureus	287	133/275 (48%)	183/275 (66%)	1.7e-61
ptmr:SPTREMBL- ACC:007854	SQUALENE DESATURASE - Staphylococcus aureus	255	113/241 (46%)	151/241 (62%)	2.9e-48
ptmr:pir- id:A55548	crtM protein - Staphylococcus aureus	254	104/241 (43%)	143/241 (59%)	4.1e-42
ptmr:SPTREMBL- ACC:Q9M608	PHYTOENE SYNTHASE - Citrus unshiu	436	85/261 (32%)	138/261 (52%)	3.0e-30
ptmr:SWISSNEW- ACC:P49085	Phytoene synthase, chloroplast precursor	410	89/262 (33%)	145/262 (55%)	1.0e-29

The homology of these sequences is shown graphically in the ClustalW analysis shown in Table 8D. NOV8 polypeptide is provided in lane 1.

**Table 8D. ClustalW Analysis of NOV8**

1) NOV8 (SEQ ID NO:16)



2)	007854	(SEQ ID NO:128)	
3)	A55548	(SEQ ID NO:129)	
4)	Q9M608	(SEQ ID NO:130)	
5)	P49085	(SEQ ID NO:131)	

NOV8	-----	1
007854	-----	1
A55548	-----	1
Q9M608	MSVTLLWVSPNSQLSNCFGVDSVREENRLFYSSRFLYQHQTRTAVFNSRPKQFNNSNKQRRNSYPLDQDLRHPCSSGI	80
P49085	MAITLVRAASPG--LS---AADSISHQGTLCQST-----LLTKTRP-----AARRWMPCSLLGLHPWEAGR	56

NOV8	-----	7
007854	-----	21
A55548	-----	21
Q9M608	DLPEIS-CMVASTAGEVAMSSEEMVYNVVLKQAALVKNQPSGVTTRDLVDNP-DIALPGTHSLISEHNDRCGEVCASVAKT	158
P49085	PSPAVYSSLFPVNPAGEAVVSSEQKVYDVVLKQAALLKRQLR--TPVLDARPDQMDMP--RNGEKEANDRGGECEVAKT	132

NOV8	FSYAFDLPEDLKRAKAIWAIYAVCRITDDSIDKKKQEQNGTARDQVITYSCDYIQAKQSTPAALNNALSNTNTYS	87
007854	FSYAFDLPEDLKRAKAIWAIYAVCRITDDSIDVYGDITQFLIQKEIQSIEKYPYEHHHFQSTRRIMMALQHVQHKNAF	101
A55548	FSYAFDLPEDLKRAKAIWAIYAVCRITDDSIDVYGDITQFLIQKEIQSIEKYPYEHHHFQSTRRIMMALQHVQHKNAF	101
Q9M608	FVLGTLTSTERRRAIWIWVWCRITDELVGPNAASHITPTALDRWESRLLELRGRFPD---MEDAALSDITTKFPVDI	235
P49085	FVLGTLTSTERRRAIWIWVWCRITDELVGPNANYITPTALDRWESRLLELRGRFPD---MEDAALSDITTKFPVDI	209

NOV8	KPFESLQYVVEDVLKEMKDSBLYEVCYGVVSTVGEITITITSS--NENNFECABSAHALCKRACHITNILRDVGEL	165
007854	QSEYNLDTIYVQHPFMKCDASLEGYCYGVAGTISEITITSS-----DHEHCTIVVRRRLGESQLINILRDVGEL	176
A55548	QSEYNLDTIYVQHPFMKCDASLEGYCYGVAGTISEITITSS-----DHEHCTIVVRRRLGESQLINILRDVGEL	175
Q9M608	QPFREYEGHMDLRKSRNPNFDLYLYCYVAGTVGLSVGVNGIAPDSCATTESVYNALALGIANOLTINILRDVGEL	315
P49085	QPFREYEGHMDLRKSRNPNFDLYLYCYVAGTVGLSVGVNGIAPDSCATTESVYNALALGIANOLTINILRDVGEL	289

NOV8	QNGRIYLSVKLAQPRNHLSTIYEGVSPNYTELWESYATETVLMKIDNGINYEDEEVRIIELAAAHHEIIVNR	245
007854	QDNERIYFSKORLQKQENDIARVYONGVNNHYIDLWEYAAIIEKDFQDVMDQHVESIEASPIIELAARVYIILGRS-	255
A55548	QDNERIYFSKORLQKQENDIARVYONGVNNHYIDLWEYAAIIEKDFQDVMDQHVESIEASPIIELAARVYIILGRS-	254
Q9M608	ARRGRVYIPQDELACAGISDDITFAEYIKRRNFMNQIKRRMFEEMANGVTELSEASAPWASLLIYRGLIDDE	395
P49085	ARRGRVYIPQDELACAGISDDITFAEYIKRRNFMNQIKRRMFEEMANGVTELSEASAPWASLLIYRGLIDDE	369

NOV8	KANST-LHEKVVYSSLEKIKIYRELSAAYNRSETL-----	279
007854	-----	255
A55548	-----	254
Q9M608	ANDNNFTIRAYVSAKRIEALPIAYASLLRPSRIYTSKA	436
P49085	ANDNNFTIRAYVCGKRIELALPVAYGSLLLPCSLRNGQT	410

BLAST analysis was performed on sequences from the Patp database, which is a proprietary database that contains sequences published in patents and patent publications. Patp results include those listed in Table 8E.

5

Table 8E. Patp BLASTP Analysis for NOV8

Sequences producing High-scoring Segment Pairs	Protein/ Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AA44217	Soybean phytoene synthase - Glycine max	400	85/261 (32%)	136/261 (52%)	3.8e-30
patp:AA484101	Amino acid sequence of a phytoene synthase polypeptide - Lycopersicon esculentum	412	85/261 (32%)	137/261 (52%)	1.3e-29
patp:AA41057	Phytoene synthase from N. benthamiana - Nicotiana benthamiana	410	83/261 (31%)	137/261 (52%)	9.0e-29
patp:AAG10658	Arabidopsis thaliana protein fragment SEQ ID NO: 9068 - Arabidopsis thaliana	422	83/261 (31%)	134/261 (51%)	1.2e-28
patp:AAG10659	Arabidopsis thaliana protein fragment SEQ ID NO: 9069 - Arabidopsis thaliana	403	83/261 (31%)	134/261 (51%)	1.2e-28

DOMAIN results for NOV8 as disclosed in Tables 8F, were collected from the Conserved Domain Database (CDD) with Reverse Position Specific BLAST analyses. This BLAST analysis software samples domains found in the Smart and Pfam collections.

Table 8F lists the domain description from DOMAIN analysis results against NOV8.

5 This indicates that the NOV8 sequence has properties similar to those of other proteins known to contain these domains.

Table 8F. Domain Analysis of NOV8			
PSSMs producing significant alignments:		Score(bits)	E value
SQS_PSY (InterPro)	Squalene/phytoene synthase	130.7	2.1e-35
SQS_PSY: domain 1 of 2, from 1 to 38: score 21.0, E = 8e-05			
(SEQ ID NO:132)	laqgSkSFalairLlppelRravlaYlwCRaaDdvVD<--*		
	+ ++  +      + ++ + ++ ++       +		
NOV8	1 MKEHSKTFSYAFDFLDLKRKKAIWAIYAVCRIIDDSID	38	
SQS_PSY: domain 2 of 2, from 69 to 262: score 109.7, E = 1.5e-29			
(SEQ ID NO:133)	DapvdraFaPCAYqALdvleefdiprepfrdlIediITkrMGaGmamD		
	++  ++ +  ++  ++  +    +		
NOV8	69 DAAIMNALS-----NTLNTYSIPKKPFESLIQ-----YVKED	100	
	lekreknlqyryatfeDlIrYCYyVAGtVGlmmlmgvrkledpAdwql		
	+ ++ ++  +     ++++++ ++ ++		
101	LVLK-----EMKTDSLDYEYCYGVVGTVGELLTPILTSSNENNf-----	139	
	eevldlrAcLGLALQLTNiARdvgEDarrGPCrVYLptewLsqyGlsle		
	+++ + ++   +     +   ++    ++     ++  ++		
140	EQAEE-AAIALGKAMQITNlRdVGEDFQNG--RIYLSVEKLAQYRVNLH	186	
	dllapentdkrirrVlrrllDnArayyedAltGlagLppqsrfpiaAApq		
	+ ++ +++ + ++ + +++ ++ +      + ++       +		
187	SIYYEGVSPN-YIELWESYATETVRLYDIALNGINyFDEEVRYIIELAAl	235	
	vYagIgdaleangydvfrRaktrkgek<--*		
	+ ++++++  +++++ +++++  +		
236	AYHEILVEVRKANY-TLHKKVYVSKLKK	262	

NOV8 is expressed in at least the following tissues: colon, brain, lung, lumph, and  
10 tonsil (enriched for germinal center b-cells).

Squalene synthase (farnesyl-diphosphate farnesyltransferase)(SQS) belongs to the squalene and phytoene synthases family. Phytoene synthase (PSY) catalyzes the conversion of two molecules of geranylgeranyl diphosphate (GGPP) into phytoene. The reaction carried out by PSY is catalyzed in two separate steps: the first is a head-to-head condensation of the two  
15 molecules of GGPP to form prephytoene diphosphate; this intermediate is then rearranged to form phytoene. psy is found in all organisms that synthesize carotenoids: plants and photosynthetic bacteria as well as some non- photosynthetic bacteria and fungi. In bacteria PSY is encoded by the gene CTRB. In plants PSY is localized in the chloroplast.

As it can be seen from the description above, both SQS and PSY share a number of  
20 functional similarities which are also reflected at the level of their primary structure. In

particular three well conserved regions are shared by SQS and PSY; they could be involved in substrate binding and/or the catalytic mechanism. Squalene synthase (farnesyl-diphosphate farnesyltransferase)(SQS) and Phytoene synthase (PSY) share a number of functional similarities. These similarities are also reflected at the level of their primary structure. In particular, three well conserved regions are shared by SQS and PSY; they could be involved in substrate binding and/or the catalytic mechanism. Squalene synthase (farnesyl-diphosphate farnesyltransferase)(SQS) catalyzes the conversion of two molecules of farnesyl diphosphate (FPP) into squalene. It is the first committed step in the cholesterol biosynthetic pathway. The reaction carried out by SQS is catalyzed in two separate steps: the first is a head-to-head condensation of the two molecules of FPP to form presqualene diphosphate; this intermediate is then rearranged in a NADP-dependent reduction, to form squalene: 2 FPP -> presqualene diphosphate + NADP -> squalene SQS is found in eukaryotes. In yeast is encoded by the ERG9 gene, in mammals by the FDFT1 gene.

The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies. For example, the compositions of the present invention will have efficacy for treatment of patients such as: Obesity, dietary disorders, Von Hippel-Lindau (VHL) syndrome, Alzheimer's disease, Stroke, Tuberous sclerosis, hypercalcaemia, Parkinson's disease, Huntington's disease, Cerebral palsy, Epilepsy, Lesch-Nyhan syndrome, Multiple sclerosis, Ataxia-telangiectasia, Leukodystrophies, Behavioral disorders, Addiction, Anxiety, Pain, Neuroprotection, Tonsillitis, Lymphedema, Allergies, Systemic lupus erythematosus, Autoimmune disease, Asthma, Emphysema, Scleroderma, allergies, ARDS and other diseases, disorders and conditions of the like.

As described earlier, NOV8 shares extensive sequence homologies with Squalene Desaturase family proteins. The structural similarities indicate that NOV8 may function as a member of Squalene Desaturase family proteins. Accordingly, the NOV8 nucleic acids and proteins identified here may be useful in potential therapeutic applications implicated in (but not limited to) various pathologies and disorders as indicated herein. For example, a cDNA encoding the Squalene Desaturase-like protein NOV8 may be useful in gene therapy, and the Squalene Desaturase-like protein NOV8 may be useful when administered to a subject in need thereof. The NOV8 nucleic acid encoding Squalene Desaturase-like protein, and the Squalene Desaturase-like protein of the invention, or fragments thereof, may further be useful in diagnostic applications, wherein the presence or amount of the nucleic acid or the protein are

to be assessed. Additional disease indications and tissue expression for NOV8 and NOV8 variants, if available, are presented in the Examples.

NOV8 nucleic acids and polypeptides are further useful in the generation of antibodies that bind immuno-specifically to the novel NOV8 substances for use in therapeutic or diagnostic methods. These antibodies may be generated according to methods known in the art, using prediction from hydrophobicity charts, as described in the “Anti-NOVX Antibodies” section below. The disclosed NOV8 protein has multiple hydrophilic regions, each of which can be used as an immunogen. In one embodiment, a contemplated NOV8 epitope is from about amino acids 1 to 35. In another embodiment, a NOV8 epitope is from about amino acids 50 to 85. In additional embodiments, NOV8 epitopes are from about amino acids 95 to 125, from about amino acids 175 to 200, from about amino acids 215 to 325, and from about amino acids 335 to 711. These novel proteins can be used in assay systems for functional analysis of various human disorders, which will help in understanding of pathology of the disease and development of new drug targets for various disorders.

**NOV9**

A disclosed NOV9 nucleic acid (SEQ ID NO:17) of 939 nucleotides (also referred to as CG55954-01) encoding a novel Lymphocyte Antigen 64-like protein is shown in Table 9A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 140-142 and ending with a TAA codon at nucleotides 920-922. Putative untranslated regions are found upstream from the initiation codon and downstream from the termination codon, and are underlined. The start and stop codons are shown in bold letters in Table 9A.

**Table 9A. NOV9 nucleotide sequence (SEQ ID NO:17)**

TTAGCAAGTCGCATTATCCTCACTAAAGGGAACAAAAGCTGGAGCTCCACCGCGGTGGCGGCCGC
TCTAGAACTAGTGGATCCCCGGGCTGCAGGAATTCGGCACGAGGGTAAACCCACCAAGCAATCC
TAGCCTGTGATGGCGTTTGACGTGAGCTGCTTCTTTTGGGTGGTGCTGTTTTCTGCCGCTGTAA
AGTCATCACCTCCTGGGATCAGATGTGCATTGAGAAAGAAGCCAACAAAACATATAACTGTGAAA
ATTTAGGTCTCAGTGAAATCCCTGACACTCTACCAAACACACAGAATTTTTGGGAATTCAGCTTT
AATTTTTTGCCTACAATTACAATAGAACCTTCAGCAATCAGCATCTTCTAGCAGGCCTACCAGT
TCTCCGGCATCTCAACTTAAAGGGAATCACTTTCAAGATGGGACTATCACGAAGACCAACCTAC
TCAGACCGTGGGCAGCTTGGAGGTTCTGATTTTGTCTCTTGTGGTCTCCTCTCTATAGACCAG
CAAGCATTCCACAGCTTGGGAAAAATGAGCCATGTAGACTTAAGCCACAACAGCCTGACATGCGA
CAGCATTGATTCTCTTAGCCATCTTAAGGGAATCTACCTCAATCTGGCTGCCAACAGCATTAAACA
TCATCTCACCCCGTCTCCTCCCTATCTTGTCCCAGCAGAGCACCATTAAATTTAAGTCATAACCCC
CTGGACTGCACTTGCTCGAATATTCACTTCTTAACATGGTACAAAGAAAACCTGCACAAACTTGA
AGGCTCGGAGGAGACCAGTGTGCAACCCGCCATCTCTAAGGGGAGTTAAGCTATCTACCTCAA
TCTGGCTGCCAACAGCATTAAATCATCTCACCCCGTCTCCTCCTATCTTGTCCCAGCAGAGCA
CCATTAATTTAAGTCATAACCCCCTGGAA

NOV9 CG55954-01 genomic clones map to chromosome 5q12.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 487 of 492 bases (98%) identical to a gb:GenBank-ID:D83597|acc:D83597.1 mRNA from *Homo sapiens* (RP105, complete cds).

A disclosed NOV9 polypeptide (SEQ ID NO:18) encoded by SEQ ID NO:17 has 260 amino acid residues and is presented in Table 9B using the one-letter amino acid code. NOV9 has an INTEGRAL Likelihood of -2.39 that it is a transmembrane protein. SignalP, Psort and/or Hydropathy results predict that NOV9 has a signal peptide and is likely to be localized to the plasma membrane with a certainty of 0.4600. The most likely cleavage site for a NOV9 peptide is between amino acids 23 and 24, i.e., at the dash between amino acids ITS-WD.

NOV9 has a molecular weight of 28738.5 Daltons.

**Table 9B. Encoded NOV9 protein sequence (SEQ ID NO:18).**

MAFDVSCFFWVLFSGACKVITSWDQMCIEKEANKTYNCENLGLSEIPDTLPNTTEFLEFSFNFLPTIHN  
RTFSNQHLLAGLPVLRHLNLKGNHFQDGTITKTNLLQTVGSLEVLILSSCGLLSIDQQAFHSLGKMSHVD  
LSHNSLTCDSIDSLHLKGIYLNLAANSINIISPRLLPILSQSTINLSHNPLDCTCSNIHFLTWYKENL  
HKLEGSEETTCCANPPSLRGVKLSTSIWLPTALTSSHPVSSLSLSCPSRAPLI

The full amino acid sequence of the protein of the invention was found to have 166 of 189 amino acid residues (87%) identical to, and 172 of 189 amino acid residues (91%) similar to, the 661 amino acid residue ptnr:SptrEmbl-ACC:Q99467 Lymphocyte Antigen 64 precursor protein from *Homo sapiens*.

In a further search of public sequence databases, NOV9 was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 9C.

**Table 9C. BLASTP results for NOV9**

Gene Index/ Identifier	Protein/ Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SPTREMBL- ACC:Q99467	LYMPHOCYTE ANTIGEN 64 PRECURSOR (RP105) - <i>Homo sapiens</i>	661	166/189 (87%)	172/189 (91%)	8.3e-83
ptnr:SPTREMBL- ACC:Q62192	LYMPHOCYTE ANTIGEN 78 PRECURSOR (RP105) - <i>Mus musculus</i>	661	111/160 (69%)	128/160 (80%)	1.4e-55

The homology of these sequences is shown graphically in the ClustalW analysis shown in Table 9D. NOV9 polypeptide is provided in lane 1.

**Table 9D. ClustalW Analysis of NOV9**

1) NOV9	(SEQ ID NO:18)
2) Q99467	(SEQ ID NO:134)
3) Q62192	(SEQ ID NO:135)
NOV9	MAFDVSCFFWVLFSGACKVITSWDQMCIEKEANKTYNCENLGLSEIPDTLPNTTEFLEFSFNFLPTIHNRTFS----- 74
Q99467	MAFDVSCFFWVLFSGACKVITSWDQMCIEKEANKTYNCENLGLSEIPDTLPNTTEFLEFSFNFLPTIHNRTFSRLMNL 80
Q62192	MAFDVSCFFWVLFSGACKVITSWDQMCIEKEANKTYNCENLGLSEIPDTLPNTTEFLEFSFNFLPTIHNRTFS----- 74
NOV9	----- 74
Q99467	FLDLTRCQINWIHEDTFQSHHQLSTLVLTGNPLIFMAETSLNGPKSLKHLFLIQTGISNLEFIPVHNLENLESYLGSNH 160
Q62192	----- 74
NOV9	----- 74

Q99467	ISSIKFPKDFPARNLKVLDLFDQNNAIHYISREDMRSLEQAINLSLNFNGNNVKGIELGAFDSTVFQSLNFGGTPNLSVIFN	240
Q62192	-----	74
NOV9	-----	74
Q99467	GLQNSTTQSLWLGTFEDIDDEDISSAMLKGLCEMSVESLNQEHFSDISSTTFQCFTQLQBLDLTATHLKGLPSGMKGL	320
Q62192	-----	74
NOV9	-----	74
Q99467	NLLKKLVLSVNHFDQLCQISAANFPSLTHLYIRGNVKKHLGVGCLEKLGNLQTLDSLHNDIEASDCCSLQKLNLSHLQT	400
Q62192	-----	74
NOV9	-----NQHLLEGLPVLRLHNLKGN	94
Q99467	LNLSHNEPLGLSQAFKECPQLELLDLAFTRLHINAPQSPFQNLHFLQVLNLTTCFLDTSNQHLLEGLPVLRLHNLKGN	480
Q62192	-----RLNLT--	80
NOV9	FQDGTITKTNLLQTVGSLEVLILSSCGLLSIDQAFHSLGKMSHVDLSHNSLTCDSIDSLSHLKGIVYINLAANSINIIS	174
Q99467	FQDGTITKTNLLQTVGSLEVLILSSCGLLSIDQAFHSLGKMSHVDLSHNSLTCDSIDSLSHLKGIVYINLAANSINIIS	560
Q62192	-----LRQCYWHDHDTCSQHEEDTEVLNANPFIEMETALSGL	127
NOV9	RLLPILSQOSTINLSNPLDCTCSNIHFLTWYKENLHKLEGSEETTCANPPSLRGVKLS-----STINPTATSS	246
Q99467	RLLPILSQOSTINLSNPLDCTCSNIHFLTWYKENLHKLEGSEETTCANPPSLRGVKLSDVKLSCGITGCHFFLVFL	640
Q62192	KHFFI--SGH-----S--SIDFMP-----LH-----NQKLESYLG-----SNE	160
NOV9	PVSS--SCPSRAP--	260
Q99467	LLAILLFFAVKY--LRWKYQHI	661
Q62192	-----	160

BLAST analysis was performed on sequences from the Patp database, which is a proprietary database that contains sequences published in patents and patent publications. Patp results include those listed in Table 9E.

5

Table 9E. Patp BLASTP Analysis for NOV9					
Sequences producing High-scoring Segment Pairs	Protein/ Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAW28510	Product of clone J422 - Homo sapiens	661	166/189 (87%)	172/189 (91%)	6.4e-83
patp:AAW87556	B cell surface protein sequence - Homo sapiens	661	166/189 (87%),	172/189 (91%)	6.4e-83
patp:AAW82527	Human RP105 protein sequence	650	166/189 (87%)	172/189 (91%)	6.4e-83
patp:AAW47274	Human B-cell activation and survival antigen-1	661	163/189 (86%)	169/189 (89%)	1.1e-80
patp:AAW11833	Human 5' EST secreted protein	75	72/74 (97%)	72/74 (97%)	1.2e-35

DOMAIN results for NOV9 as disclosed in Tables 9F, were collected from the Conserved Domain Database (CDD) with Reverse Position Specific BLAST analyses. This BLAST analysis software samples domains found in the Smart and Pfam collections. Table 9F lists the domain description from DOMAIN analysis results against NOV9.

10

Table 9F. Domain Analysis of NOV9			
PSSMs producing significant alignments:		Score(bits)	E value
LRRCT (InterPro)	Leucine rich repeat C-terminal domain	44.4	2.6e-09
LRR (InterPro)	Leucine Rich Repeat	28.8	0.00013

```

LRR: domain 1 of 4, from 54 to 77: score 4.2, E = 1.7e+02
  (SEQ ID NO:136)      nLeeLdLsnNnLsGslPpesfgnLp<-*
                      |+| |+| | +++++ +|+| +
NOV9          54      TTEFLEFSFNFLP-TIHNRTFSNQH      77

LRR: domain 2 of 4, from 84 to 107: score 4.1, E = 1.7e+02
  (SEQ ID NO:137)      nLeeLdLsnNnLs.GslPpesfgnLp<-*
                      |++|+| +|++++|++      |+
NOV9          84      VLRLHLNLKGNHFDGTITK--TNLLQ      107

LRR: domain 3 of 4, from 111 to 134: score 16.6, E = 0.59
  (SEQ ID NO:138)      nLeeLdLsnNnLsGslPpesfgnLp<-*
                      +||+| ||++ | |+ +++++| +|
NOV9          111      SLEVLILSSCGLL-SIDQQAFFHSLG      134

LRR: domain 4 of 4, from 135 to 158: score 14.0, E = 3.7
  (SEQ ID NO:139)      nLeeLdLsnNnLsGslPpesfgnLp<-*
                      + + |||+|+|+ + +|+++|+
NOV9          135      KMSHVLDLSHNSLT-CDSIDSLSHLK      158

LRRCT: domain 1 of 1, from 191 to 254: score 44.4, E = 2.6e-09
  (SEQ ID NO:140)      NPfnCDCeLrwLlrWlretnprredqedlrCasPeslrGqpl....
                      ||++|+|+ +|+| +| | +|++|+++|+|+||| | +|+++
NOV9          191      NPLDCTCSNIHFLTWYKE-NLHKLEGSEETTCANPPSLRGVKLtsi 236

                      .....lellp..sdfsCp<-*
                      ++ |+ +++ |++|||
237 wlptaLTSSHpvSSLSCP      254

```

5 Lymphocyte antigen 64 (RP105) is a B cell Toll like receptor (TLR) that transmits a growth-promoting signal and is implicated in the life/death decision of B cells. The growth-promoting signal activation by RP105 leads to resistance against irradiation-induced apoptosis and massive B-cell proliferation. RP105 has tandem repeats of a leucine-rich motif in the extracellular domain that is expected to be involved in protein-protein interactions. Role of RP105 has been implicated not only in B cell proliferation but also in secretion of large quantities of LPS-neutralizing antibodies as an innate immune responses to bacterial cell wall lipopolysaccharide. Loss of RP105 has been implicated in increased disease activity in
 10 systemic lupus erythematosus.

The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from: bacterial infection, allergic disease such as asthma, B
 15 cell neoplasms, auto-immune diseases such as systemic lupus erythematosus (SLE), histocystic leukemia, hairy cell leukaemia, polymphocytic leukaemia, myelomas and other diseases, disorders and conditions of the like.

NOV9 shares extensive sequence homologies with Lymphocyte Antigen 64 family proteins. The structural similarities indicate that NOV9 may function as a member of
 20 Lymphocyte Antigen 64 family proteins. Accordingly, the NOV9 nucleic acids and proteins

identified here may be useful in potential therapeutic applications implicated in (but not limited to) various pathologies and disorders as indicated herein. For example, a cDNA encoding the Lymphocyte Antigen 64-like protein NOV9 may be useful in gene therapy, and the Lymphocyte Antigen 64-like protein NOV9 may be useful when administered to a subject in need thereof. The NOV9 nucleic acid encoding Lymphocyte Antigen 64-like protein, and the Lymphocyte Antigen 64-like protein of the invention, or fragments thereof, may further be useful in diagnostic applications, wherein the presence or amount of the nucleic acid or the protein are to be assessed.

The Lymphocyte Antigen 64 disclosed in this invention is expressed in at least the following tissues: Adrenal gland, bone marrow, brain - amygdala, brain - cerebellum, brain - hippocampus, brain - substantia nigra, brain - thalamus, brain -whole, fetal brain, fetal kidney, fetal liver, fetal lung, heart, kidney, lymphoma - Raji, mammary gland, pancreas, pituitary gland, placenta, prostate, salivary gland, skeletal muscle, small intestine, spinal cord, spleen, stomach, testis, thyroid, trachea, uterus. Based on the tissues in which NOV9 is most highly expressed, specific uses include developing products for the diagnosis or treatment of a variety of diseases and disorders associated therewith. Additional specific expression of NOV9 in normal and diseased tissues are shown in the Examples.

NOV9 nucleic acids and polypeptides are further useful in the generation of antibodies that bind immuno-specifically to the novel NOV9 substances for use in therapeutic or diagnostic methods. These antibodies may be generated according to methods known in the art, using prediction from hydrophobicity charts, as described in the "Anti-NOVX Antibodies" section below. The disclosed NOV9 protein has multiple hydrophilic regions, each of which can be used as an immunogen. In one embodiment, a contemplated NOV9 epitope is from about amino acids 1 to 35. In another embodiment, a NOV9 epitope is from about amino acids 50 to 85. In additional embodiments, NOV9 epitopes are from about amino acids 95 to 125, from about amino acids 175 to 200, from about amino acids 215 to 325, and from about amino acids 335 to 711. These novel proteins can be used in assay systems for functional analysis of various human disorders, which will help in understanding of pathology of the disease and development of new drug targets for various disorders.

#### **NOV10**

A disclosed NOV10 nucleic acid (SEQ ID NO:19) of 2349 nucleotides (also referred to as CG55910-01) encoding a novel ACYL-COA DESATURASE-like protein is shown in Table 10A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 260-262 and ending with a TGA codon at nucleotides 1250-1252. Putative



untranslated regions are found upstream from the initiation codon and downstream from the termination codon, and are underlined. The start and stop codons are shown in bold letters in Table 10A.

<b>Table 10A. NOV10 nucleotide sequence (SEQ ID NO:19).</b>	
TATTTTAATCCCCCCCCCCCCGAGCCATATGGGGGATACGCCAGCAACAGACGCCCGGCCGCC	
AAGATCTGCATCCCTAGGCCACGCTAAGACCCTGGGGAAGAGCGCAGGAGCCCCGGGAGAAGGGC	
TGGAAGGAGGGGACTGGACGTGCGGAGAATTCCCCCTAAAAGGCAGAAGCCCCCGCCCCACC	
CTCGAGCTCCGCTCGGGCAGAGCGCCTGCCTGCCTGCCGCTGCTGCGGGCGCCACCTCGCCCA	
GCC <b>ATGCC</b> AGGCCCCGGCCACCGACGCGGGGAAGATCCCTTTCTGCGACGCCAAGGAAGAAATCC	
GTGCCGGGCTCGAAAGCTCTGAGGGCGGCGGCCCGGAGAGGCCAGGCGCGCGGGCAGCG	
GCAGAACATCGTCTGGAGGAATGTCGTCTGATGAGCTTGCTCCACTTGGGGCCGTGTACTCC	
CTGGTGCTCATCCCCAAGCCAAGCCACTCACTCTGCTCTGGGCCTACTTCTGCTTCTCTCTGG	
CCGCTCTGGGTGTGACAGCTGGTGCCCATCGCTTGTGGAGCCACAGGTCTACCGGGCCAAGCT	
GCCTCTGAGGATATTTCTGGCTGTGCGCAACTCCATGGCTTTCAGAATGACATCTTCGAGTGG	
TCCAGGGACACCGAGCCACCAAGTACTCAGAGACGGATGCTGACCCCACAATGCCCGCC	
GGGGCTTCTTCTTCTCCCATATTGGGTGGCTGTTTGTTCGCAAGCATCGAGATGTTATTGAGAA	
GGGGAGAAAGCTTGACGTCACTGACCTGCTTGCTGATCCTGTGGTCCGGATCCAGAGAAAGTAC	
TATAAGATCTCCGTGGTGTCTATGTGCTTTGTGGTCCCCACGCTGGTGCCTTGGTACATCTGGG	
GAGAGAGTCTGTGGAATTCCTACTTCTTGGCCTCTATTCTCCGCTATACCATCTCACTCAACAT	
CAGCTGGCTGGTCAACAGCGCGCCACATGTATGGAACCGGCCCTATGACAAGCACATCAGC	
CCTCGGCAGAACCCTCGTCTGCTCTGGGTGCCATTGGTGAAGGCTTCCATAATTACCATCACA	
CCTTTCCCTTTGACTACTCTGCGAGTGAATTTGGCTTAAATTTTAACCCAACCACCTGGTTCAT	
TGATTTTCATGTGCTGGCTGGGCTGGCCACTGACCGCAAACGGGCAACCAAGCCGATGATCGAG	
GCCCCGAAGGCCAGGACTGGAGACAGCAGTGCT <b>TGA</b> ACTTGGAACAGCCATCCCATGTCTGC	
CGTTGCAACCTCGGTTTCATGGCTTTGGTTACAATAGCTCTCTTGATACATTGGATCGTGGGAGGG	
GGCAGAGGGTGGGGAAGGAACGAGTCAATGTGGTTTGGGAATGTTTTTGTATTCTCAAAATAA	
TGTTGAAATACAATTATCAATGAAAAAATTTTCGTTTTTTTTTTGGTTGGTTTTGTTTTGAG	
ACAGAGTCTCACTCTGTCAACCAGGCTGGAGTGCAGTGGCGCAGTCTCGGCTCACTGCAGCCTC	
CACCTACCTGGTTCAAGCAATTCTCCTGCCTCAGCCTCCTGAGTAGCTGAGATTACAGGAGCCT	
GCCACCACACCCAGCTAATTTTGTATTTTAGTAGAGACAGGGTTTCATCATGTTGGCCAG	
ACTGGCCTCGAATTCCTGACCTCAGGCAATCCACCCGCCTCGGCCTCCCAAAGAGCTGGGATTA	
CAGGCGTGAGCCACCGCACCTGCCGAAAAAACTTTTTTTTTTTGAGACGAGGCTCGCTCTG	
TCCCCAGGTCTGGATGTGCAGTGGCGAGATTTAGCTCACTGACAAGCTCCGCCTCCCGGGGT	
TCACGCCATTCTCCTGCCTCAGCCTCCCGAGTAGCTGGGGAGCCAGCGCGCCAGCCTAAAAAA	
CTTTTCAGGTCAATATTACTACGATTTAACTTTACGAGTGTGGACCTGTGATTTAATCGGCTAT	
TAGCTAAGAAATAGCGTCAAATTATTTCGTGTGTATTGTGGCTTGAACATTGATGGCTAACCTT	
CCTGGAAAGGGATGAAGGCAAAGTAATATTTCTTTTAGTGGTAGTTCAGGAGACCATGTGGTCT	
CCTTTGTCTACCAATTTACCCGATCATGTGTTATTAAAAACACCCCTTCTGGAGGACAAAGAGGG	
GTTACACACACAGGGGTCTTGTGCGGCAACACAGCAGGTCCGGTGACCATCGGGCGGCGGGGTC	
TCGCGGCTCCAACCTCACCCGGCACACAGACAACAGACGGGCTGATCTCGGGGTACCGGAAGCC	
TCGTGAAACAAATATCGCCGTTTGTCTCGACGCCAACTGCTAT	

5           The ACYL-COA DESATURASE NOV10 disclosed in this invention maps to chromosome 4.

          In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 805 of 808 bases (99%) identical to a gb:GENBANK-ID:AK024685|acc:AK024685.1 mRNA from Homo sapiens (Homo sapiens cDNA: FLJ21032  
10   fis, clone CAE07365).

          A disclosed NOV10 polypeptide (SEQ ID NO:20) encoded by SEQ ID NO:19 has 330 amino acid residues and is presented in Table 10B using the one-letter amino acid code.

          SignalP, Psort and/or Hydropathy results predict that NOV10 has a signal peptide and is likely

to be localized extracellularly with a certainty of 0.6000. In an alternative embodiment, NOV10 is likely to be localized to the Golgi with a certainty of 0.4000, or to the endoplasmic reticulum (membrane) with a certainty of 0.3000, or to the microbody (peroxisome) with a certainty of 0.3000. NOV10 is likely a Type IIIa membrane protein (Ncyt Cexo) and has a likely cleavage site between pos. 16 and 17, i.e., at the dash in the amino acid sequence CDA-KE.

**Table 10B. Encoded NOV10 protein sequence (SEQ ID NO:20).**

MPGPATDAGKIPFCDAKEEIRAGLESSEGGGPERPGARGQRQNIWVRNVVLMSSLHLGAVYSLVLIPKAKP  
LTLWAYFCFLAALGVTAGAHLWSHRSYRAKLPLRIFLAVANSMAFQNDIFEWSRDHRAHHKYSETDADP  
HNARRGFFFSHIGWLFVRKHRDVIEKGRKLDVTDLLADPVVRIQRKYKISVVLNCFVVPVTLVPWYIWGESL  
WNSYFLASILRYTISLNISWLVNSAAHMYGNRPYDKHISPRQNPLVALGAIGEGFHNHYHTFPFDYSASEFG  
LNFNPTTWFIIDFCWLGLATDRKRATKPMIEARKARTGDSSA

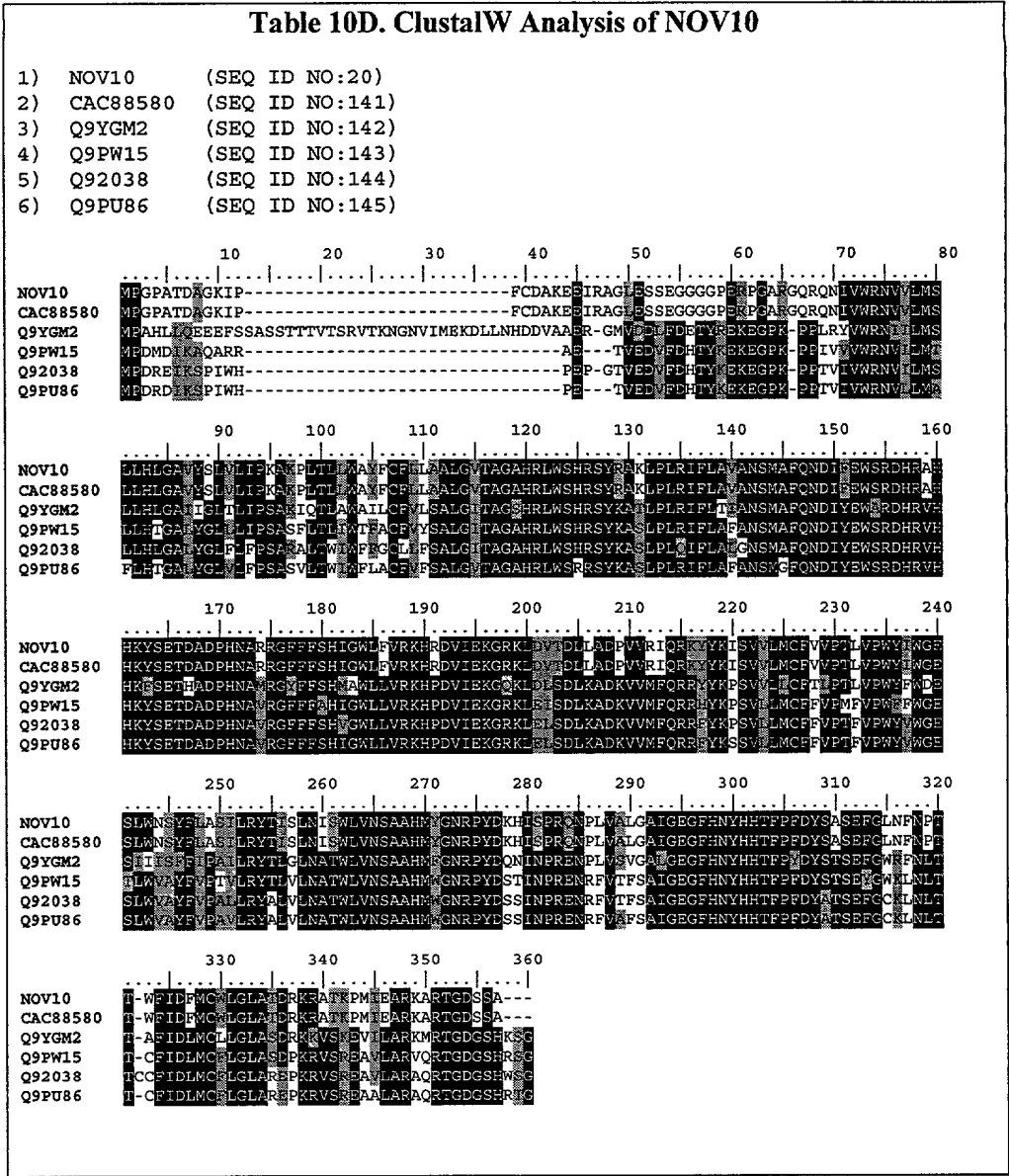
The full amino acid sequence of the protein of the invention was found to have 203 of 284 amino acid residues (71%) identical to, and 242 of 284 amino acid residues (85%) similar to, the 357 amino acid residue ptnr:SPTREMBL-ACC:Q9YGM2 protein from Gallus gallus (Chicken) (ACYL-COA DESATURASE 1 (EC 1.14.99.5) (STEAROYL-COA DESATURASE 1) (FATTY ACID DESATURASE 1).

In a further search of public sequence databases, NOV10 was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 10C.

**Table 10C. BLASTP results for NOV10**

Gene Index/ Identifier	Protein/ Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:REMTREMBL- ACC:CAC88580	SEQUENCE 1 FROM PATENT WO0166758 - Homo sapiens	330	330/330 (100%)	330/330 (100%)	1.8e-183
ptnr:SPTREMBL- ACC:Q9YGM2	ACYL-COA DESATURASE (EC 1.14.99.5) (STEAROYL- COA DESATURASE) (FATTY ACID DESATURASE) (DELTA(9)-DESATURASE) - Gallus gallus	357	203/284 (71%)	242/284 (85%)	2.7e-116
ptnr:SPTREMBL- ACC:Q9PW15	ACYL-COA DESATURASE (EC 1.14.99.5) (STEAROYL- COA DESATURASE) (FATTY ACID DESATURASE) (DELTA(9)-DESATURASE) - Ctenopharyngodon idella	324	200/285 (70%)	236/285 (82%)	1.7e-114
ptnr:SPTREMBL- ACC:Q92038	ACYL-COA DESATURASE (EC 1.14.99.5) (STEAROYL- COA DESATURASE) (FATTY ACID DESATURASE) (DELTA(9)-DESATURASE) - Cyprinus carpio	327	200/286 (69%)	234/286 (81%)	2.0e-113
ptnr:SPTREMBL- ACC:Q9PU86	ACYL-COA DESATURASE (EC 1.14.99.5) (STEAROYL- COA DESATURASE) (FATTY ACID DESATURASE) (DELTA(9)-DESATURASE) - Cyprinus carpio	324	201/285 (70%)	230/285 (80%)	6.7e-113

The homology of these sequences is shown graphically in the ClustalW analysis shown in Table 10D. The NOV10 polypeptide is provided in lane 1.



5 BLAST analysis was performed on sequences from the Patp database, which is a proprietary database that contains sequences published in patents and patent publications. Patp results include those listed in Table 10E.

Table 10E. Patp BLASTP Analysis for NOV10					
Sequences producing High-scoring Segment Pairs	Protein/ Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAG63225	Amino acid sequence of a human lipid metabolism enzyme - Homo sapiens	330	330/330 (100%)	330/330 (100%)	1.4e-183

patp:AAG63850	Amino acid sequence of human fatty acid desaturase 25934 - Homo sapiens	330	330/330 (100%)	330/330 (100%)	1.4e-183
patp:AAG63934	Amino acid sequence of human fatty acid desaturase 25934 - Homo sapiens	330	330/330 (100%)	330/330 (100%)	1.4e-183
patp:AAY69378	Amino acid sequence of human skin stearyl-CoA desaturase - Homo sapiens	359	187/284 (65%)	234/284 (82%)	2.1e-107
patp:AAR25853	MSH-dependent protein obtd. from hamster flank organ - Mesocricetus auratus	354	181/284 (63%)	233/284 (82%)	3.6e-105

Table 10I lists domain descriptions from pfam analysis for NOV10. This indicates that the NOV10 sequence has properties similar to those of other proteins known to contain these domains and similar to the properties of these domains.

5

Table 10F. Domain Analysis of NOV10									
Pfam analysis									
Model	Domain	seq-f	seq-t	hmm-f	hmm-t	score	E-value		
-----	-----	-----	-----	-----	-----	-----	-----		
Desaturase	1/1	51	295 ..	1	248 []	505.3	4.7e-148		
Alignments of top-scoring domains:									
Desaturase: domain 1 of 1, from 51 to 295: score 505.3, E = 4.7e-148									
(SEQ ID NO:146)		illgalHlgAlyllallptelkwktvivalllyvitGGIGITaGyHR							
		+ +++       +  ++ +    ++ +++ + +    +  +							
NOV10	51	VLMSLLHLGAVYS-LVLIPKAKPLTLLWAYFCFLAA-LGVTAGAHR 95							
		LwsHRSYkaklpLrifLaifgtlAvQgsiyeWardHRAHHkysDTdaDPH							
		+                + + + +  +  ++  +   +               +							
		96 LWSHRSYRAKLPLRIFLAVANSMAFQNDIFEWSRDHRAHHKYSETDADPH 145							
		danRGFFfSHvGWlLvkkhPavkekgkldlsDLkaDpVvrFqhryYipl							
		+ +            +      ++							

The ACYL-COA DESATURASE disclosed in this invention is expressed in at least the following tissues: Brain, adrenal gland, eye, retina, colon, ovary, testis.

The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from: Endometriosis, Fertility, Von Hippel-Lindau (VHL) syndrome, Alzheimer's disease, Stroke, Tuberous sclerosis, hypercalcaemia, Parkinson's disease, Huntington's disease, Cerebral palsy, Epilepsy, Lesch-Nyhan syndrome, Multiple sclerosis, Ataxia-telangiectasia, Leukodystrophies, Behavioral disorders, Addiction, Anxiety, Pain, Neuroprotection, Diabetes and other diseases, disorders and conditions of the like.

(OMIM 604031) Stearoyl-CoA desaturase (SCD; EC 1.14.99.5) is an iron-containing enzyme that catalyzes a rate-limiting step in the synthesis of unsaturated fatty acids. The principal product of SCD is oleic acid, which is formed by desaturation of stearic acid. The ratio of stearic acid to oleic acid has been implicated in the regulation of cell growth and differentiation through effects on cell-membrane fluidity and signal transduction. By RT-PCR of adipose tissue RNA with primers based on the sequence of rat SCD, a partial human SCD cDNA was isolated. Using RNase protection assays, it was recently found that human SCD was expressed at higher levels in colon and esophageal carcinomas than in the counterpart normal tissues. Additional cDNAs corresponding to the full-length human SCD transcript were cloned leading to 6 predicted amino acid changes. It was recently reported that the deduced 359-amino acid SCD protein contains the 3 highly conserved histidine-containing regions that are essential for the enzyme's catalytic activity. The coding region of human SCD shares 85% and 82% nucleotide identity with those of mouse Scd1 and Scd2, respectively. Northern blot analysis revealed that SCD is expressed ubiquitously as 3.9- and 5.2-kb mRNAs, with the highest levels in brain and liver. The 2 transcripts arise from use of alternative polyadenylation signals. It was demonstrated that the human SCD gene spans approximately 24 kb and contains 6 exons. They noted that the organization of the human, mouse, and rat SCD genes is very similar. By analysis of a somatic cell hybrid panel, the SCD gene was mapped to chromosome 10 and a transcriptionally inactive, processed SCD pseudogene to chromosome 17. Deletions were identified in the Scd1 gene in the asebia (ab) mutant mouse, which has rudimentary sebaceous glands and develops alopecia. Fatty acid

desaturases (EC 1.14.99.-) are enzymes that catalyze the insertion of a double bond at the delta position of fatty acids.

There are two distinct families of fatty acid desaturases which do not seem to be evolutionary related. Family 1 is composed of: Stearoyl-CoA desaturase (SCD) (EC 1.14.99.5). SCD is a key regulatory enzyme of unsaturated fatty acid biosynthesis. SCD introduces a cis double bond at the delta(9) position of fatty acyl-CoA's such as palmitoleoyl- and oleoyl-CoA. SCD is a membrane-bound enzyme that is thought to function as a part of a multienzyme complex in the endoplasmic reticulum of vertebrates and fungi. Family 2 is composed of: Plants stearoyl-acyl-carrier-protein desaturase (EC 1.14.99.6), these enzymes catalyze the introduction of a double bond at the delta(9) position of stearoyl-ACP to produce oleoyl-ACP. This enzyme is responsible for the conversion of saturated fatty acids to unsaturated fatty acids in the synthesis of vegetable oils. Cyanobacteria desA an enzyme that can introduce a second cis double bond at the delta position of fatty acid bound to membranes glycerolipids. DesA is involved in chilling tolerance; the phase transition temperature of lipids of cellular membranes being dependent on the degree of unsaturation of fatty acids of the membrane lipids.

## NOV11

A disclosed NOV11 nucleic acid of 1411 nucleotides (also referred to as CG50281-01) (SEQ ID NO:21) encoding a novel WNT-10B PROTEIN PRECURSOR-like protein is shown in Table 11A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 254-256 and ending with a TGA codon at nucleotides 1280-1282. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined and the start and stop codons are in bold in Table 11A.

**Table 11A. NOV11 nucleotide sequence (SEQ ID NO:21 )**

<p>CAAGTGTGTTGTGAGTCTGTGTCTGAGTTTGCAAGTGAGTGTGTGTCTGTGTGCCGGGC  GTTGTGTCTGATTGGGCAAGGTTCCAGGGGTGCTCGCTTGAGTCCTGAGCTGGGACAACG  CCTTGACTCTTCTTTAAGACCTCCAAGCCTCAGGGACTCTGGGAATCAAGGGGTGTT  TCTTCTGTTTTGTTTGAGGAGGAATGAGAAGGGTCCTGATCGATCTGCCACCGGAGCC  TCCGGGCTTCGACATGCTGGAGGAGCCCCGGCCGCGCCTCCGCCCTCGGGCCTCGCGGG  TCTCCTGTTCTGGCGTTGTGCAGTCGGGCTCTAAGCAATGAGATTCTGGGCCTGAAGTT  GCCTGGCGAGCCGCGCTGACGGCCAACACCGTGTGCTTGACGCTGTCCGGCCTGAGCAA  GCGGCAGCTAGGCCTGTGCTGCGCAACCCCGACGTGACGGCGTCCGCGCTTCAGGGTCT  GCACATCGCGGTCCACGAGTGTGACGACAGCTGCGCGACAGCGCTGGAAGTCTCCGC  GCTTGAGGGCGGCGGCCCTGCGCACCACAGCGCCATCCTCAAGCGCGGTTTCCGAGA  AAGTGTCTTTTCTTCTCCATGCTGGCTGCTGGGTCATGCACGAGTAGCCACGGCCTG  CAGCCTGGGCAAGCTGGTGAGCTGTGGCTGTGGCTGGAAGGGCAGTGGTGAGCAGGATCG  GCTGAGGGCCAACTGCTGCAGCTGCAGGCACTGTCCCAGGGGAAGGCTCCCCGGGACAT  CCAGGCACGAATGCAATCCACAACAACAGGGTGGGGCGCCAGGTGGTAACTGAAACCT  GAAGCGGAAATGCAAGTGTGATGGCACATCAGGCAGCTGCCAGTTCAAGACATGCTGGAG</p>
---

GGCGGCCCCAGAGTTCCGGGCAGTGGGGCGGCGTTGAGGGAGCGGGTGGGCCGGGCCAT  
 CTTCAATTGATACCCACAACCGCAATTCTGGAGCCTTCCAGCCCCGTCTGCGTCCCCGTCTG  
 CCTCTCAGGAGAGCTGGTCTACTTTGAGAAGTCTCCTGACTTCTGTGAGCGAGACCCAC  
 TATGGGCTCCCCAGGGACAAGGGGCCGGGCCTGCAACAAGACCAGCCGCCTGTTGGATGG  
 CTGTGGCAGCCTGTGCTGTGGCCGTGGGCACAACGTGCTCCGGCAGACACGAGTTGAGCG  
 CTGCCATTGCCGCTTCCACTGGTGCTGCTATGTGCTGTGTGATGAGTGCAAGGTTACAGA  
 GTGGGTGAATGTGTGTAAGTGAGGGTCAACCTTACCTTGGGGCTGGGGAAAAGGACTGTG  
 TGAAAGGAAGCGCCTTTTCAACCCTTTGCTATGATTTCTTCCAAGGTCACTCTTGGCCC  
 CTGGAAGCTTAAAGATCTACCTGGAAAAAAC

The WNT-10B PROTEIN PRECURSOR-like NOV11 disclosed in this invention maps to chromosome 12.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 641 of 654 bases (98%) identical to a gb:GENBANK-

5 ID:HSU81787|acc:U81787.1 mRNA from Homo sapiens (Human Wnt10B mRNA, complete cds).

A disclosed NOV11 polypeptide (SEQ ID NO:22) encoded by SEQ ID NO:21 has 342 amino acid residues and is presented in Table 11B using the one-letter code. NOV11 polypeptides are likely Type Ib (Nexo Ccyt) membrane proteins. Analysis of NOV11 with  
 10 INTEGRAL software predicts a likelihood of -3.88 of having a transmembrane domain at residues 157 - 173 (156 - 174). The SignalP, Psort and/or Hydropathy results predict that NOV11 has a signal peptide and is likely to be localized extracellularly with a certainty of 0.3700. In an alternative embodiment, NOV11 is likely to be localized to the lysosome (lumen) with a certainty of 0.1900, or to the endoplasmic reticulum (membrane) with a  
 15 certainty of 0.1000, or to the endoplasmic reticulum (lumen) with a certainty of 0.1000. The most likely cleavage site for a NOV11 signal peptide is between amino acids 28 and 29, *i.e.*, at the dash in the sequence ALS-NE.

**Table 11B. NOV11 protein sequence (SEQ ID NO:22)**

MLEEP RPRPPPSGLAGLLFLALCSRALSNEILGLKLPGEPPLTANTVCLTSLGSLSKRQLG  
 LCLRNP DVTASALQGLHIAVHECQHQLRDQRWNC SALEGGGRLPHHSAILKRGFRSAFS  
 FSM LAAGVMHAVATACSLGKLVSCGCGWKSGEQDRLRAKLLQLQALS R GKAPRDIQARM  
 RIHNNRVGRQVV TENLKRKCKCHGTSGSCQFKTCWRAAPEFRAVG AALRERVGRAIFIDT  
 HNRNSGAFQ PRLRPRRLSGELVYFEKSPDFCERDPTMGSPGTRGRACNKTSRLLDGCGSL  
 CCGRGHNVL RQTRVERCHCRFWHCCYVLCDECKVTEWVNVCK

The full amino acid sequence of the protein of the invention was found to have 171 of 176 amino acid residues (97%) identical to, and 173 of 176 amino acid residues (98%) similar  
 20 to, the 389 amino acid residue ptrn:SWISSPROT-ACC:O00744 protein from Homo sapiens (Human) (WNT-10B PROTEIN PRECURSOR (WNT-12)).

In a search of public sequence databases, NOV11 was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 11C.

Table 11C. BLASTP results for NOV11					
Gene Index/ Identifier	Protein/ Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:TREMBLNEW- ACC: BAB72181	WNT10B - Homo sapiens	389	171/176 (97%)	173/176 (98%)	4.5e-189
ptnr:SWISSPROT- ACC: O00744	WNT-10B protein precursor (WNT-12) - Homo sapiens	389	171/176 (97%)	173/176 (98%)	2.5e-188
ptnr:SWISSPROT- ACC: P48614	WNT-10B protein precursor (WNT-12) - Mus musculus	389	168/176 (95%)	172/176 (97%)	9.8e-185
ptnr:SPTREMBL- ACC: P79753	WNT10B - Fugu rubripes (Japanese pufferfish) (Takifugu rubripes)	390	123/208 (59%)	154/208 (74%)	2.5e-119
ptnr:SWISSPROT- ACC: P70701	WNT-10A protein precursor - Mus musculus	417	119/182 (65%)	136/182 (74%)	2.0e-117

- A multiple sequence alignment is shown in Table 11D, with the protein of the invention being shown on the first line in a ClustalW analysis comparing the protein of the invention with related protein sequences shown in Table 11C.

Table 11D. ClustalW Analysis of NOV11	
1) NOV11 CG50281-01 (SEQ ID NO:22)	
2) BAB72181 (SEQ ID NO:147)	
3) O00744 (SEQ ID NO:148)	
4) P48614 (SEQ ID NO:149)	
5) P79753 (SEQ ID NO:150)	
6) P70701 (SEQ ID NO:151)	
<pre> 10      20      30      40      50      60      70      80 NOV11  -----MLLEPR-PRPPPSGLAGLLFLALCSRALS-----NEILGLKLPGEPPPLTANTVCLTSLGSLSKRQICLCRLNPD BAB72181 -----MLLEPR-PRPPPSGLAGLLFLALCSRALS-----NEILGLKLPGEPPPLTANTVCLTSLGSLSKRQICLCRLNPD O00744  -----MLLEPR-PRPPPSGLAGLLFLALCSRALS-----NEILGLKLPGEPPPLTANTVCLTSLGSLSKRQICLCRLNPD P48614  -----MLLEPR-SRPPPSGLAGLLFLALCSRALS-----NEILGLKLPGEPPPLTANTVCLTSLGSLSKRQICLCRLNPD P79753  -----MEPPH---KFRWDKFLILATALMSPAFF-VLQNTILSLKAGEPPPLTNSVCLKLEGLSKRQIRRCQRRSPD P70701  MGSAPRPWRLRLEPCGCRREFWLEFFILLAPAVPRSAFNEILGLKLPPEPVLNANTVCLTLPGLSKRQNEWCVRRPD </pre>	
<pre> 90      100     110     120     130     140     150     160 NOV11  VTASALQGLHIAVHECQHQLRDQRWNCSSALEGGGRLPHHSAILKRGFRESAFSFSMLAAGVMHAVATACSLGKLVSCGCG BAB72181 VTASALQGLHIAVHECQHQLRDQRWNCSSALEGGGRLPHHSAILKRGFRESAFSFSMLAAGVMHAVATACSLGKLVSCGCG O00744  VTASALQGLHIAVHECQHQLRDQRWNCSSALEGGGRLPHHSAILKRGFRESAFSFSMLAAGVMHAVATACSLGKLVSCGCG P48614  VTASALQGLHIAVHECQHQLRDQRWNCSSALEGGGRLPHHSAILKRGFRESAFSFSMLAAGVMHAVATACSLGKLVSCGCG P79753  ATASALCCQVATHECQHQLRDQRWNCSSLEGLCLPHHNTILNRCGFRESAFSLMLAAGVAHSAVACSGLKRGCGCE P70701  VASALQGHQIATHECQHQLRDQRWNCSSLETRNKVFESEPIFSRGFRESAFVATAAGVYHAVENACILGKIKCGCD </pre>	
<pre> 170     180     190     200     210     220     230     240 NOV11  WKSGSGQDRLRAKL---LQLQALSRGY-----APRDIQA BAB72181 WKSGSGQDRLRAKL---LQLQALSRGHSFPHSLSPGPGSSSPGQPDITNEWGGCNHMDGEKFSRDFLDSREAPRDIQA O00744  WKSGSGQDRLRAKL---LQLQALSRGHSFPHSLSPGPGSSSPGQPDITNEWGGCNHMDGEKFSRDFLDSREAPRDIQA P48614  WKSGSGQDRLRAKL---LQLQALSRGYTFPISSPVPVGSVSPGQPDITNEWGGCNHMDGEKFSRDFLDSREAPRDIQA P79753  AKRRQDDKRIKLTLQLOLSLQDD-LS-----SMQETNEWGGCSHDRIYCDRFSRDILDSRCSPRDIHA P70701  ASRRSGDEAFRRKLHRLQLDALQEGKLSHGVEHPAILPASPGLODSNEWGGCSPDRCGERFSRDFLDSREPRDIHA </pre>	
<pre> 250     260     270     280     290     300     310     320 NOV11  RMRIHNNRVGRQVVNTENLKRCKCHGTSGSCQFKTCWRAAEFRAVGAALRERVGRAIFIDTHNRRNSGAFQPR----- BAB72181 RMRIHNNRVGRQVVNTENLKRCKCHGTSGSCQFKTCWRAAEFRAVGAALRERVGRAIFIDTHNRRNSGAFQPR----- O00744  RMRIHNNRVGRQVVNTENLKRCKCHGTSGSCQFKTCWRAAEFRAVGAALRERVGRAIFIDTHNRRNSGAFQPR----- </pre>	



P48614	RMRIHNNRVGRQVVTENLKRKCKCHGTSGSCQFKTCWRAAPEFRAGALRERMSRAIFIDTHNRNSGAFQPR-----
P79753	RMRIHNNRVGRQVVTENLKRKCKCHGTSGSCQFKTCWVSPFPRLVGSHLEKFLSAILNNSNNKNGVNPFIKSGVSG
P70701	RMRIHNNRVGRQVVTENLKRKCKCHGTSGSCQFKTCWVTEPFRTVGLLENGFHRATLIRPHNRNCGQLDGP-AGAPS
	330 340 350 360 370 380 390 400
NOV11	-----LRPRRLSGELVYFEKSPDFCERDPTMGSPGTRGRACNKTSLRLDGGGSLCCGRGHNVLRQTRVERCHCRFHWG
BAB72181	-----LRPRRLSGELVYFEKSPDFCERDPTMGSPGTRGRACNKTSLRLDGGGSLCCGRGHNVLRQTRVERCHCRFHWG
000744	-----LRPRRLSGELVYFEKSPDFCERDPTMGSPGTRGRACNKTSLRLDGGGSLCCGRGHNVLRQTRVERCHCRFHWG
P48614	-----LRPRRLSGELVYFEKSPDFCERDPTMGSPGTRGRACNKTSLRLDGGGSLCCGRGHNVLRQTRVERCHCRFHWG
P79753	STGGLNCGRRSSSRRLVYFEKSPDFCEPNLSYDSAGTSGRIKNKTSSTSGGSLCCGRGHNVLRQTRVERCHCRFHWG
P70701	PAPGTPGRRRASHSELVYFEKSPDFCEREPRIDSASTVERLCKNKSTGPDGGGSLCCGRGHNVLRQTRVERCHCRFHWG
	410
NOV11	CYVLCDECKVTEWVNVCK
BAB72181	CYVLCDECKVTEWVNVCK
000744	CYVLCDECKVTEWVNVCK
P48614	CYVLCDECKVTEWVNVCK
P79753	CYVLCDECKVTEWVNVCK
P70701	CYVLCDECKVTEWVNVCK

Other BLAST results include sequences from the Patp database, which is a proprietary database that contains sequences published in patents and patent publications. Patp results include those listed in Table 11E.

**Table 11E. Patp BLASTP Analysis for NOV11**

Sequences producing High-scoring Segment Pairs	Protein/Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAW08928	Wnt-10b protein - Homo sapiens	389	171/176 (97%)	173/176 (98%)	4.6e-187
patp:AAR53689	HR2 polypeptide - Homo sapiens	389	168/176 (95%)	172/176 (97%)	7.6e-185
patp:AAV94319	Murine Wnt-10A protein - Mus musculus	417	119/182 (65%)	136/182 (74%)	1.6e-117
patp:AAV28559	Wnt-10a polypeptide #1 - Homo sapiens	417	119/182 (65%)	137/182 (75%)	4.1e-117
patp:AAB95835	Human protein sequence SEQ ID NO:18862 - Homo sapiens	417	119/182 (65%)	137/182 (75%)	2.3e-116

5 Table 11F lists the domain description from DOMAIN analysis results against NOV11.

**Table 11F. Domain Analysis of NOV11**

Pfam analysis							
Model	Domain	seq-f	seq-t	hmm-f	hmm-t	score	E-value
-----	-----	-----	-----	-----	-----	-----	-----
wnt	1/2	47	161 ..	1	115 [.	133.3	4.1e-48
Metallothio_2	1/1	142	214 ..	1	85 [ ]	-33.6	7.4
wnt	2/2	174	342 .]	160	352 .]	292.7	4.5e-106
Alignments of top-scoring domains:							
wnt: domain 1 of 2, from 47 to 161: score 133.3, E = 4.1e-48							
(SEQ ID NO:152)	lCrs1PGLsprQrqlCrrnpdvmasvseGaq1aiqECQhQFRgrRWN						
	+   +      +  +         +   + +++ ++						

1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397
------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

$$| \quad | + \quad | ++ \qquad + \qquad + \quad + \quad | \quad | + \quad | + \quad | \quad | + \quad | \quad | ++ \quad + \quad | \quad | + \quad | \quad | \quad | + \quad | \quad | \quad | + \quad | \quad |$$

CGCDdkRkadeerlrikL&lt;-\*

$$||| + | \quad ++ + ||| ||$$

(SEQ ID NO:153) MSCsCGGnCGCGSgCkCGsGCgGCKmYpdlsettssttteatTlvlg

$$|| + || + || + \quad ||| + \quad + + + \quad || \quad + \quad +$$

VAPEkkaqfegsEmgvavaaeenGCKC.GsnCkCdPCNC< - \*

+ + + + + | + + + | | | + | + + | + |

(SEQ ID NO:154) rdrdaRsLMNLHNNEAGRkaVkshmrreCKCHGvSGSCslKTCWlsL

|| + ++ || || ++ || ++ || + || || || + || || + || || ++

PdFReVGdlLKeKYdgAieVevnkrkgqrs1ssrkqasaleaanerfkk

$$\begin{array}{|c|} \hline + \\ \hline \end{array} \begin{array}{|c|} \hline + \\ \hline \end{array} \begin{array}{|c|c|} \hline ++ \\ \hline \end{array} \begin{array}{|c|} \hline + \\ \hline \end{array} + \begin{array}{|c|} \hline + \\ \hline \end{array} + \begin{array}{|c|c|} \hline ++ \\ \hline \end{array} \begin{array}{|c|c|} \hline ++ \\ \hline \end{array} \begin{array}{|c|c|c|c|} \hline ++++ \\ \hline \end{array}$$

PtrnQYTDLVYlEkSPDYCerdretGslGTqGRvCnktSkGlgWRDgCel

$$+ \mid \mid + \mid \mid \mid + \mid \mid \mid + \mid \mid + \mid \mid + \mid \mid + \mid \mid \mid + \mid \mid \mid ++$$

LCCGRGYnteqKvertেকCnCkFHNGWCCyVkCeeCtevvevhtCK<~\*

|||||+ ++ ++|+|+|+| || ||||| |+| |+ +++| +||

5

The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from: neurodegenerative disorders, epilepsy, cancers including but not limited to brain tumor, colon cancer and breast cancer, developmental disorders, and neural tube defects and other diseases, disorders and conditions of the like.

WNT genes encode intercellular signaling glycoproteins that play important roles in key processes of embryonic development such as mesoderm induction, specification of the embryonic axis, and patterning of the central nervous system, spinal cord, and limbs. The name WNT denotes the relationship of this family to the *Drosophila* segment polarity gene 'wingless,' and to its vertebrate ortholog *Int1*, a mouse protooncogene. It was noted that multiple WNT genes are known to exist in several species that have been investigated ranging from *Drosophila* to man. They have been classified into various groups and subgroups on the basis of high sequence homology and common expression patterns.

The vertebrate WNT8 subfamily includes genes from *Xenopus*, zebrafish, and chicken; the first mammalian WNT8 homolog, a human member of the Wnt8 family that they termed WNT8B was characterized on the basis of the very high sequence similarity (90-91% identity) of the inferred protein to those encoded by the *Xenopus* and zebrafish Wnt8b genes. The human cDNA encodes a 295-amino acid polypeptide that contains a C2H2 zinc finger-like motif. A predominant 1.9-kb mRNA was detected in a variety of adult and fetal tissues. They used PCR typing of a human monochromosomal hybrid cell panel to map the gene to chromosome 10, and fluorescence in situ hybridization for localization at 10q24. Recently, the full-length cDNA sequence and genomic organization of the human WNT8B gene was reported along with studies of expression of the gene in human and mouse embryos. The WNT8B gene contains 6 exons separated by small introns, with the exception of intron 1. The predicted protein has 351 amino acids. The gene is expressed predominantly as a transcript of approximately 2.1 kb. The human and mouse expression patterns appeared to be identical and were restricted to the developing brain, with the great majority of expression being found in the developing forebrain. In the latter case, expression was confined to the germinative neuroepithelium of 3 sharply delimited regions: the dorsomedial wall of the telencephalic ventricles (which includes the developing hippocampus), a discrete region of the dorsal thalamus, and the mammillary and retromammillary regions of the posterior hypothalamus. Expression in the developing hippocampus may suggest a role for WNT8B in patterning of this region, and subchromosomal localization of the human gene to 10q24 may suggest it as a

candidate gene for partial epilepsy (EPT; OMIM-600512) in families in which the disease has been linked to markers in this region. WNT1 (OMIM- 164820) is a member of a family of cysteine-rich, glycosylated signaling proteins that mediate diverse developmental processes such as the control of cell proliferation, adhesion, cell polarity, and the establishment of cell fates.

Wnt1 was identified as an oncogene activated by the insertion of mouse mammary tumor virus in virus-induced mammary adenocarcinomas. Although Wnt1 is not expressed in the normal mammary gland, expression of Wnt1 in transgenic mice causes mammary tumors. To identify downstream genes in the WNT signaling pathway that are relevant to the transformed cell phenotype, a PCR-based cDNA subtraction strategy and suppression subtractive hybridization was used. Two genes, WISP1 and WISP2 (OMIM- 603399), were identified that are upregulated in the mouse mammary epithelial cell line transformed by Wnt1, but not by Wnt4 (OMIM- 603490). Together with a third related gene, WISP3 (OMIM- 603399), these proteins define a subfamily of the connective tissue growth factor family. Two distinct systems demonstrated WISP induction to be associated with the expression of WNT1. WISP1 genomic DNA was amplified in colon cancer cell lines and in human colon tumors and its RNA overexpressed in 84% of the tumors examined compared with patient-matched normal mucosa. WISP3 also was overexpressed in 63% of colon tumors analyzed. In contrast, WISP2 showed reduced RNA expression in 79% of the tumors. These results suggested that WISP genes may be downstream of WNT1 signaling and that aberrant levels of WISP expression in colon cancer may play a role in colon tumorigenesis. It was found that the WISP1 cDNA encodes a 367-amino acid protein. Mouse and human WISP1 proteins are 84% identical; both have hydrophobic N-terminal signal sequences, 38 conserved cysteine residues, and 4 potential N-linked glycosylation sites. Alignment of the 3 human WISP proteins showed that WISP1 and WISP3 are most similar (42%), whereas WISP2 had 37% identity with WISP1 and 32% identity with WISP3.

Several members of the Wnt gene family have been shown to cause mammary tumors in mice. Using degenerate primer PCR on human genomic DNA and specific PCR of cDNA libraries, a Wnt gene was isolated that had not previously been described in human. It is the human homolog of mouse Wnt10b, which had been shown to be one of the oncogenes cooperating with FGF3 in the development of mouse mammary tumor virus (MMTV)-induced mammary carcinomas in mice. The human WNT10B sequence is 88 and 95% identical to the murine gene at nucleotide and amino acid levels, respectively. By YAC and fluorescence in situ hybridization (FISH) mapping, the gene was localized to 12q13, a chromosomal region

frequently rearranged in human tumors and also containing the WNT1 gene. WNT10B expression was not observed in normal and benign proliferations of human breast tissue but was found to be elevated in 3 of 50 primary breast carcinomas. Southern blot analysis of the carcinoma expressing the highest level of WNT10B showed no amplification or rearrangement of the gene. It was recently demonstrated that the WNT10B gene encodes a 389-amino acid protein with 96.6% sequence identity to mouse Wnt10b. The expression pattern showed that it is synthesized in many adult tissues with the highest levels found in heart and skeletal muscle. By PCR typing of a human/rodent monochromosomal panel and FISH, they mapped WNT10B to 12q13.1. It was recently shown that WNT signaling, likely mediated by WNT10B, is a molecular switch that governs adipogenesis. WNT signaling maintains preadipocytes in an undifferentiated state through inhibition of the adipogenic transcription factors CEBPA and PPAR-gamma. When WNT signaling in preadipocytes is prevented by overexpression of axin or dominant-negative TCF4, these cells differentiate into adipocytes. Disruption of WNT signaling also causes transdifferentiation of myoblasts into adipocytes in vitro, highlighting the importance of this pathway not only in adipocyte differentiation but also in mesodermal cell fate determination.

## NOV12

NOV12 includes two novel Kilon Protein Precursor-like proteins disclosed below. The disclosed sequences have been named NOV12a and NOV12b. Unless specifically addressed as NOV12a or NOV12b, any reference to NOV12 is assumed to encompass all variants.

## NOV12a

A disclosed NOV12a nucleic acid of 1196 nucleotides (also referred to as CG55920-01) (SEQ ID NO:23) encoding a novel Kilon Protein Precursor-like protein is shown in Table 12A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 94-96 and ending with a TAA codon at nucleotides 1156-1158. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined and the start and stop codons are in bold in Table 12A.

**Table 12A. NOV12a nucleotide sequence (SEQ ID NO:23)**

<p>GCGCGCCGCTGGTTCCCGGGAAGACTCGCCAGCACCAGGGGGTGGGGGAGTGCGAGCTG  AAAGCTGCTGGAGAGTGAGCAGCCCTAGCAGGGATGGACATGATGCTGTTGGTGCAGGGT  GCTTGTGCTCGAACCAGTGGCTGGCGGCGGTGCTCCTCAGCCTGTGCTGCCTGCTACCC  TCCTGCCTCCCGGCTGGACAGAGTGTGGACTTCCCCTGGGCGGCCGTGGACAACATGATG  GTCAGAAAAGGGGACACGGCGGTGCTTAGGTGTTATTTGGAAGATGGAGCTTCAAAGGGT</p>
---

GCCTGGCTGAACCGGTCAAGTATTATTTTTCGGGAGGTGATAAGTGGTCAGTGGATCCT  
CGAGTTTCAATTTCAACATTGAATAAAAGGGACTACAGCCTCCAGATACAGAATGTAGAT  
GTGACAGATGATGGCCCATACACGTGTTCTGTTTCACTCAACATACACCCAGAACAATG  
CAGGTGCATCTAACTGTGCAAGTTCCTCCTAAGATATATGACATCTCAAATGATATGACC  
GTCAATGAAGGAACCAACGTCACTCTTACTTGTGTTGGCCACTGGGAAACCAGAGCCTTCC  
ATTTCTTGGCGACACATCTCCCATCAGCAAAACCATTGAAAATGGACAATATTGGAC  
ATTTATGGAATTACAAGGGACAGGCTGGGGAATATGAATGCAGTGCGGAAAATGATGTG  
TCATTCCCAGATGTGAGGAAAGTAAAGTTGTTGTCACTTTGCTCCTACTATTCAGGAA  
ATTAAATCTGGCACCGTGACCCCGGACGCAGTGGCCTGATAAGATGTGAAGGTGCAGGT  
GTGCCGCTCCAGCCTTTGAATGGTACAAAGGAGAGAAGAAGCTCTTCAATGGCCAACAA  
GGAATTATTATTCAAATTTTAGCACAGATCCATTCTCACTGTTACCAACGTGACACAG  
GAGCACTTCGGCAATTATACCTTGTGTGGCTGCCAACAAGCTAGGCACAACCAATGCGAGC  
CTGCCTCTTAACCTCCAAGTACAGCCAGTATGGAATTACCGGGAGCGCTGATGTTCTT  
TTCTCCTGCTGGTACCTTGTGTTGACACTGTCTCTTTCACCAGCATATTCTACCTGAAG  
AATGCCATTCTACAATAAATTCAAAGACCCATAAAAGGCTTTAAGGATTCTCTGA

The KILON PROTEIN PRECURSOR-like NOV12a disclosed in this invention maps to chromosome 1.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 1003 of 1167 bases (85%) identical to a gb:GENBANK-

- 5 ID:AB017139|acc:AB017139.1 mRNA from Rattus norvegicus (Rattus norvegicus mRNA for Kilon, complete cds).

- 10 A disclosed NOV12a polypeptide (SEQ ID NO:24) encoded by SEQ ID NO:23 has 354 amino acid residues and is presented in Table 12B using the one-letter code. The Psort and Hydropathy results predict that this sequence has a signal peptide and is likely to be localized extracellularly with a certainty of 0.8200. In an alternative embodiment, NOV12a is likely to be localized to the lysosome (lumen) with a certainty of 0.5088, or to the endoplasmic reticulum (membrane) with a certainty of 0.1000, or to the endoplasmic reticulum (lumen) with a certainty of 0.1000. Most likely cleavage site for a NOV12a signal peptide is between pos. 33 and 34, i.e., at the dash in the sequence CLP-AG.

**Table 12B. NOV12a protein sequence (SEQ ID NO:24)**

MDMMLLVQGACCSNQWLA AVL LSLCCLLP SCLPAGQSVDFPWA AVDNMMVRKGD TAVLRC  
YLEDGASKGAWLNRSS IIFAGDKWSVDPRVSI STLNRDYS LQIQNV DVTDDGPYTCSV  
QTQHTPRTMQVHLTVQVPPKIYDI SNDMTVN EGTNVT LTCLATGKPEPSISWRHISPSAK  
PFENGQYLDIYGITRDQAGEYECSAENDVSFPDVRKV KVVVNFAPTIQEIKSGTVTPGRS  
GLIRCEGAGVPPPAFEWYKGEKKLFNGQQGII IQNFSTRSILTVTNVTQEHFGNYTCVAA  
NKLGT TNASLP LNPPSTAQYGITGSADVLFSCWYLVLT LSSFTSIFYLKNAILQ

- 15 The full amino acid sequence of the protein of the invention was found to have 334 of 352 amino acid residues (94%) identical to, and 341 of 352 amino acid residues (96%) similar to, the 348 amino acid residue ptmr:SWISSPROT-ACC:Q9Z0J8 protein from Rattus norvegicus (Rat) (KILON PROTEIN PRECURSOR (KINDRED OF IGLON)).

The NOV12a disclosed in this invention is expressed in at least the following tissues: brain. The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from: Von Hippel-Lindau (VHL) syndrome, Alzheimer's disease, Stroke, Tuberosus sclerosis, hypercalcaemia, Parkinson's disease, Huntington's disease, Cerebral palsy, Epilepsy, Lesch-Nyhan syndrome, Multiple sclerosis, Ataxia-telangiectasia, Leukodystrophies, Behavioral disorders, Addiction, Anxiety, Pain, Neuroprotection and other diseases, disorders and conditions of the like.

## NOV12b

A disclosed NOV12b nucleic acid of 1165 nucleotides (also referred to as CG55920-04) (SEQ ID NO:25) encoding a novel Kilon Protein Precursor-like protein is shown in Table 12C. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 77-79 and ending with a TAA codon at nucleotides 1139-1141. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined and the start and stop codons are in bold in Table 12C.

**Table 12C. NOV12b nucleotide sequence (SEQ ID NO:25)**

```

CGGGAAGACTCGCCAGCACCTGGGGGTGGGGGAGTGCAGCTGAAAGCTGCTGGAGAGTG
AGCAGCCCTAGCAGGGATGGACATGATGCTGTTGGTGCAGAGTGCCTGTTGCTCGAACCA
GCGGCTGGCGGCGGTGCTTCTCAGCCTGTGCTGCCTGCTACCCTCCTGCCTCCCGGCTGG
ACAGAGTGTGGACTTCCCCTGGGCGGCCGTGGACAACATGATGGTCAGAAAAGGGGACAC
GGCGGTGCTTAGGTGTTATTTGGAAGATGGAGCTTCAAAGGGTGCCTGGCTGAACCGGTC
AAGTATTATTTTTCGGGGAGGTGATAAGTGGTCAGTGGATCCTCGAGTTTCAATTTCAAC
ATTGAATAAAAGGACTACAGCCTCCAGATACAGAATGTAGATGTGACAGATGATGGCCC
ATACACGTGTTCTGTTTCAGACTCAACATACACCCAGAACAAATGCAGGTGCATCTAACTGT
GCAAGTTCCTCCTAAGATATATGACATCTCAAATGATATGACCGTCAATGAAGGAACCAA
CGTCACTCTTACTTGTGTTGGCCACTGGGAAACCAGAGCCTTCCATTTCTTGGCGACACAT
CTCCCCATCAGCAAAACCATTTGAAAATGGACAATATTTGGACATTTATGGAATTACAAG
GGACCAGGCTGGGGAATATGAATGCAGTGCAGGAAATGATGTGTGATTCCAGATGTGAG
GAAAGTAAAGTTGTTGTCAACTTTGCTCCTACTATTGAGGAAATTAAATCTGGCACCGT
GACCCCGGACGAGTGGCCTGATAAGATGTGAAGGTGCAGGTGTGCCGCTCCAGCCTT
TGAATGGTACAAAGGAGAGAAGAAGCTCTTCAATGGCCAACAAGGAATTATTATCAAAA
TTTTAGCACAAAGATCCATTCTCACTGTTACCAACGTGACACAGGAGCACTTCGGCAATTA
TACTTGTGTGGCTGCCAACAAGCTAGGCACAACCAATGCGAGCCTGCCTCTTAACCTCC
AAGTACAGCCAGTATGGAATTACCGGGAGCGTGATGTCTTTTCTCCTGCTGTTACCT
TGTGTTGACACTGTCTCTTTCCAGCATATTCTACCTGAAGAATGCCA
TTCTACAATAAATTCAAAGACCCATAAAAGGCTTT

```

The KILON PROTEIN PRECURSOR-like NOV12b disclosed in this invention maps to chromosome 1.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 989 of 1154 bases (85%) identical to a gb:GENBANK-ID:AB017139|acc:AB017139.1 mRNA from Rattus norvegicus (Rattus norvegicus mRNA for Kilon, complete cds).

5 A disclosed NOV12b polypeptide (SEQ ID NO:26) encoded by SEQ ID NO:25 has 354 amino acid residues and is presented in Table 12B using the one-letter code. NOV12b seems to be a Type II (Ncyt Cexo) membrane protein with an INTEGRAL Likelihood of -5.41 Transmembrane 17 - 33 (15 - 36). The Psort and Hydropathy results predict that this sequence has a signal peptide and is likely to be localized at the Golgi body with a certainty of 0.9000.

10 In an alternative embodiment, NOV12b is likely to be localized to the mitochondrial inner membrane with a certainty of 0.8084, or to the plasma membrane with a certainty of 0.6500, or to the mitochondrial intermembrane space with a certainty of 0.4883. Most likely cleavage site for a NOV12b signal peptide is between pos. 33 and 34, i.e., at the dash in the sequence CLP-AG.

**Table 12D. NOV12b protein sequence (SEQ ID NO:26)**

MDMMLLVQSACCSNQRLAAVLLSLCCLLPSPAGQSVDFPWAADVNDMMVRKGD TAVLRC YLEDGASKGAWLNRSSII FAGGDKWSVDPVRSISTLNKRDYSLQIQNVDTVDDGPYTCSV QTQHTPRMQVHLTVQVPPKIYDISNDMTVNEGTNVTLTCLATGKPEPSISWRHISPSAK PFENGQYLDIYGITRDQAGEYECSAENDVSFPDVRKVKV VVNFAPTIQEIKSGTVTPGRS GLIRCEGAGVPPPAFEWYKGEKKLFNGQQGII IQNFSTRSILTVTNVTQE HFGNYTCVAA NKLGTNASLPLNPPSTAQYGITGSADVL FSCWYLVLTLSSTFSIFYLKNAILQ
---

15 The full amino acid sequence of the protein of the invention was found to have 332 of 352 amino acid residues (94%) identical to, and 339 of 352 amino acid residues (96%) similar to, the 348 amino acid residue ptmr:SWISSPROT-ACC:Q9Z0J8 protein from Rattus norvegicus (Rat) (KILON PROTEIN PRECURSOR (KINDRED OF IGLON)).

20 The KILON PROTEIN PRECURSOR-like gene disclosed in this invention is expressed in at least the following tissues: brain. The nucleic acids and proteins of the invention have applications in the diagnosis and/or treatment of various diseases and disorders. For example, the compositions of the present invention will have efficacy for the treatment of patients suffering from: Von Hippel-Lindau (VHL) syndrome , Alzheimer's disease, Stroke, Tuberous sclerosis, hypercalcaemia, Parkinson's disease, Huntington's disease, Cerebral palsy, 25 Epilepsy, Lesch-Nyhan syndrome, Multiple sclerosis, Ataxia-telangiectasia, Leukodystrophies, Behavioral disorders, Addiction, Anxiety, Pain, Neuroprotection, as well as other diseases, disorders and conditions.



NOV12a and NOV12b share a high degree of homology as is shown in the amino acid alignment in Table 12E.

**Table 12E. Clustal W Alignment of NOV12a and NOV12b**

	10	20	30	40	50	60	70	80
CG55920_01	MDMMLLVG	ACCSNQ	LAAYLLSL	CCLLPSC	LPAQGSVD	FWAAVDNM	VRKGD	TAVLR
CG55920_04	MDMMLLVG	ACCSNQ	LAAYLLSL	CCLLPSC	LPAQGSVD	FWAAVDNM	VRKGD	TAVLR
	90	100	110	120	130	140	150	160
CG55920_01	GGDKWSVD	PRVSI	STLNKRD	YSLOIQ	NVDVTD	DDGPYT	CSVQ	TOHTPT
CG55920_04	GGDKWSVD	PRVSI	STLNKRD	YSLOIQ	NVDVTD	DDGPYT	CSVQ	TOHTPT
	170	180	190	200	210	220	230	240
CG55920_01	LATGKPEP	SIWRH	ISPSAK	PFENGQ	YLDIYG	ITRDQ	AGEYEC	SAENDV
CG55920_04	LATGKPEP	SIWRH	ISPSAK	PFENGQ	YLDIYG	ITRDQ	AGEYEC	SAENDV
	250	260	270	280	290	300	310	320
CG55920_01	GLIRCEG	AGVPP	PAFENY	KGEKK	LFNGQ	QGIIT	QNFSTR	SILTV
CG55920_04	GLIRCEG	AGVPP	PAFENY	KGEKK	LFNGQ	QGIIT	QNFSTR	SILTV
	330	340	350					
CG55920_01	GITGSAD	VLFS	CWYL	VLT	LS	SFTS	FYL	KNAI
CG55920_04	GITGSAD	VLFS	CWYL	VLT	LS	SFTS	FYL	KNAI

- 5 In a search of public sequence databases, NOV12 was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 12F.

**Table 12F. BLASTP results for NOV12**

Gene Index/ Identifier	Protein/Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SWISSPROT- ACC:Q9Z0J8	Kilon protein precursor (Kindred of IgLON) - Rattus norvegicus	348	334/352 (94%)	341/352 (96%)	1.8e-181
ptnr:SPTREMBL- ACC:Q9W6V2	NEUROTRACTIN-L - Gallus gallus	352	290/351 (82%)	317/351 (90%)	5.5e-157
ptnr:SPTREMBL- ACC:Q9W6V1	NEUROTRACTIN-S - Gallus gallus	261	183/226 (80%)	200/226 (88%)	1.6e-95
ptnr:SWISSPROT- ACC:Q13449	Limbic system-associated membrane protein precursor (LSAMP) - Homo sapiens	338	186/323 (57%)	236/323 (73%)	1.6e-95
ptnr:SWISSPROT- ACC:Q98919	Limbic system-associated membrane protein precursor (E19S) (CHLAMP, G19-isoform) - Gallus gallus	338	182/323 (56%)	236/323 (73%)	8.8e-95

A multiple sequence alignment is shown in Table 12G, with the protein of the invention being shown on the first line in a ClustalW analysis comparing the protein of the invention with related protein sequences shown in Table 12F.

**Table 12G. ClustalW Analysis of NOV12**

1)	NOV12a	CG55920-01	(SEQ ID NO:24)
2)	Q9Z0J8		(SEQ ID NO:155)
3)	Q9W6V2		(SEQ ID NO:156)
4)	Q9W6V1		(SEQ ID NO:157)
5)	Q13449		(SEQ ID NO:158)
6)	Q98919		(SEQ ID NO:159)

	10	20	30	40	50	60	70	80
NOV12a	MDMILLVQAGCCSNQWLA	AVLLSLCCLLPSCCPAGOSVDFPMAAVDNMMVRK	GD	TAVLR	CYLEDGASKGAWLN	RSSII	FA	
Q9Z0J8	--MVLLEAGGACCSNQWLA	AVLLSLC---	SCCPAGOSVDFPMAAVDNMMVRK	GD	TAVLR	CYLEDGASKGAWLN	RSSII	FA
Q9W6V2	--MVLLEVGAGCCSNQWLA	AVLLGLCCLLPAGRLAPGGDFPCAAADSLVVRK	GD	TAVLR	CYLEDGASKGAWLN	RSSII	FA	
Q9W6V1	--MVLLEVGAGCCSNQWLA	AVLLGLCCLLPAGRLAPGGDFPCAAADSLVVRK	GD	TAVLR	CYLEDGASKGAWLN	RSSII	FA	
Q13449	--MVGRLV---	PDRKQLPLVLLRLCLLPAGLEVR	-SVD	FN-RGTDN	ITVR	CGDTAHLRCVLE	DKNSMVAVLN	RSGII
Q98919	--MVARA---	PDRKQLPLVLLRLCLLPAGLEVR	-SVD	FT-RGTDN	ITVR	CGDTAHLRCVLE	DKNSMVAVLN	RSGII

	90	100	110	120	130	140	150	160	
NOV12a	GGCKWSVDPRVSI	STLNKR	DYS	LQIQVDV	TDG	PYTCSVQ	TOHTPR	TMQVHLTVQVPPKIKDIS	NDMTVNEGANVT
Q9Z0J8	GGCKWSVDPRVSI	STLNKR	DYS	LQIQVDV	TDG	PYTCSVQ	TOHTPR	TMQVHLTVQVPPKIKDIS	NDMTVNEGANVT
Q9W6V2	GGCKWSVDPRVSI	TANRREYS	LQIQVDV	TDG	PYTCSVQ	TOHTPR	TMQVHLTVQVSPKIER	ISSD	HTVNEGSNVT
Q9W6V1	GGCKWSVDPRVSI	TANRREYS	LQIQVDV	TDG	PYTCSVQ	TOHTPR	TMQVHLTVQVSPKIER	ISSD	HTVNEGSNVT
Q13449	GGCKWSVDPRVSE	EKRHSLEYS	LQIQVDV	YCEGS	YTC	SVQTOH	EPKISQV	HLTVQVPPKIS	NISSD
Q98919	GGCKWSVDPRVSE	EKRHSLEYS	LQIQVDV	YCEGS	YTC	SVQTOH	EPKISQV	HLTVQVPPKIS	NISSD

	170	180	190	200	210	220	230	240	
NOV12a	LATGKPEP	ISWRHISPSAKP	PFNGQVLDI	YGITRDQAGE	YEC	SAENDVS	FPDVKV	VVNEAPTIO	ELKSGT
Q9Z0J8	LATGKPEP	ISWRHISPSAKP	PFNGQVLDI	YGITRDQAGE	YEC	SAENDVS	FPDVKV	VVNEAPTIO	ELKSGT
Q9W6V2	LATGKPEP	ISWRHISPSAKP	PFNGQVLDI	YGITRDQAGE	YEC	SAENDVS	FPDVKV	VVNEAPTIO	ELKSGV
Q9W6V1	LATGKPEP	ISWRHISPSAKP	PFNGQVLDI	YGITRDQAGE	YEC	SAENDVS	FPDVKV	VVNEAPTIO	ELKSGV
Q13449	VANGPPE	VLRHHPAGRE	FEGBEYVILG	ITRECS	SGYECK	ANEDVSSAD	VKVT	VNXPPT	IT
Q98919	VANGPPE	VLRHHPAGRE	FEGBEYVILG	ITRECS	SGYECK	ANEDVSSAD	VKVT	VNXPPT	IT

	250	260	270	280	290	300	310	320	
NOV12a	SGLLRCEGAGV	PPAF	FEWYKGEK	KLFGQO	QITIKNF	STRSLT	VTNVT	TEH	RGNYTCVAANKLGT
Q9Z0J8	SGLLRCEGAGV	PPAF	FEWYKGEK	KLFGQO	QITIKNF	STRSLT	VTNVT	TEH	RGNYTCVAANKLGT
Q9W6V2	NGLLRCEGAGV	PPAF	FEWYKGER	KLFGQO	QITIKNF	STRSLT	VTNVT	TEH	RGNYTCVAANKLGM
Q9W6V1	NGLLRCEGAGV	PPAF	FEWYKGER	KLFGQO	QITIKNF	STRSLT	VTNVT	TEH	RGNYTCVAANKLGM
Q13449	QASLRCEASAV	PPAF	FEWYRD	DTIR	-INSAN	EDKSTG	SSSLT	VTNVT	TEH
Q98919	QASLRCEASAV	PPAF	FEWYRD	DTIR	-INSAN	EDKSTG	SSSLT	VTNVT	TEH

	330	340	350				
NOV12a	YGITGSAD	VLFS	CWYLVLTLS	SFTSIF	YLNK	NAI	LQ
Q9Z0J8	YGITGSAD	VLFS	CWYLVLTLS	SFTSIF	YLNK	NAI	LQ
Q9W6V2	YGITGSAD	VLFS	CWYLVLTLS	SFTSIF	YLNK	NAI	LQ
Q9W6V1	YGITGSAD	VLFS	CWYLVLTLS	SFTSIF	YLNK	NAI	LQ
Q13449	YGITGSIS	AVPL	RLAAS	LLCL	LK	---	---
Q98919	VDNCSVS	AVPL	RLAAS	LLCL	LK	---	---

Other BLAST results include sequences from the Patp database, which is a proprietary database that contains sequences published in patents and patent publications. Patp results include those listed in Table 12H.

**Table 12H. Patp BLASTP Analysis for NOV12**

Sequences producing High- scoring Segment Pairs	Protein/ Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAB31212	Amino acid sequence of human polypeptide PRO6004 - Homo sapiens	354	354/354 (100%)	354/354 (100%)	7.2e-194
patp:AAB44331	Human PRO4993 protein sequence SEQ ID NO:612 - Homo sapiens	352	351/352 (99%)	351/352 (99%)	7.4e-192
patp:AAW05152	Human LAMP residues 8- 332 - Homo sapiens	325	186/323 (57%)	236/323 (73%)	1.2e-95
patp:AAW05153	Rat LAMP residues 1-332 - Rattus rattus	338	185/323 (57%)	235/323 (72%)	6.8e-95
patp:AAW05154	Rat LAMP residues 1-332 - Rattus rattus	338	185/323 (57%)	235/323 (72%)	6.8e-95

Table 12I lists the domain description from DOMAIN analysis results against NOV12.

Table 12F. Domain Analysis of NOV12									
Pfam analysis									
Model	Domain	seq-f	seq-t	hmm-f	hmm-t	score	E-value		
ig	1/3	53	120	..	1 45 []	26.5	1.1e-06		
ig	2/3	153	205	..	1 45 []	28.4	3e-07		
ig	3/3	238	299	..	1 45 []	27.6	5.4e-07		
Alignments of top-scoring domains:									
ig: domain 1 of 3, from 53 to 120: score 26.5, E = 1.1e-06									
(SEQ ID NO:160)		GesvtLtCsvgfgpp.p.vtWlrngk.....							
		+++ + + ++ +    + ++++ + +++ + ++							
NOV12a	53	GDTAVLRRCYLE---DGaSkGAWLNRSSiifaggdkwsvdprvsistl 96							
		....lslti.svtpeDsgGtYtCvv<-*							
		+++++ + +++  +							
	97	nkrdYSLQIqNVDVTDD-GPYTCVS						120	
ig: domain 2 of 3, from 153 to 205: score 28.4, E = 3e-07									
(SEQ ID NO:161)		GesvtLtCsvgfgpp.p.vtWlrngk.....lslti.svtpeD							
		++    + +++ ++ +++ ++ +++     ++							
NOV12a	153	GTNVTLTCLAT--GKPePsISWRHISPsakpfengQYLDIyGITRDQ 197							
		sgGtYtCvv<-*							
		+  +    +							
	198	A-GEYECSA						205	
ig: domain 3 of 3, from 238 to 299: score 27.6, E = 5.4e-07									
(SEQ ID NO:162)		GesvtLtCsvgfgpp.p.vtWlrngk.....lsl							
		++ +    +  + +++ + +++++ ++ ++++							
NOV12a	238	GRSGLIRCEGA--GVPPaFEWYKGEKklfngqqgiinqfstrSIL 282							
		ti.svtpeDsgGtYtCvv<-*							
		+++ + +   +        +							
	283	TVtNVTQEHF-GNYTCVA						299	

In the central nervous system, many cell adhesion molecules are known to participate in the establishment and remodeling of the neural circuit. Some of the cell adhesion molecules are known to be anchored to the membrane by the glycosylphosphatidylinositol (GPI) inserted to their C termini, and many GPI-anchored proteins are known to be localized in a Triton-

insoluble membrane fraction of low density or so-called "raft." A novel protein was found in this fraction which was an immunoglobulin superfamily member with three C2 domains and has six putative glycosylation sites. Since this protein shows high sequence similarity to IgLON family members including LAMP, OBCAM, neurotrimin, CEPU-1, AvGP50, and GP55, this protein was termed Kilon (a kindred of IgLON). Kilon immunostaining was observed in the cerebral cortex and hippocampus, in which the strongly stained puncta were observed on dendrites and soma of pyramidal neurons.

The basic structure of immunoglobulin (Ig) molecules is a tetramer of two light chains and two heavy chains linked by disulfide bonds. There are two types of light chains: kappa and lambda, each composed of a constant domain (CL) and a variable domain (VL). There are five types of heavy chains: alpha, delta, epsilon, gamma and mu, all consisting of a variable domain (VH) and three (in alpha, delta and gamma) or four (in epsilon and mu) constant domains (CH1 to CH4). Members of the immunoglobulin superfamily are found in hundreds of proteins of different functions. Examples include antibodies, the giant muscle kinase titin and receptor tyrosine kinases. Immunoglobulin-like domains may be involved in protein-protein and protein-ligand interactions.

### NOV13

NOV13 includes two novel Organic Cation Transporter-like proteins disclosed below. The disclosed sequences have been named NOV13a and NOV13b. Unless specifically addressed as NOV13a or NOV13b, any reference to NOV13 is assumed to encompass all variants.

### NOV13a

A disclosed NOV13a nucleic acid of 2069 nucleotides (also referred to as CG55988-01) (SEQ ID NO:27) encoding a novel Organic Cation Transporter-like protein is shown in Table 13A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 279-281 and ending with a TAA codon at nucleotides 1881-1883. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined and the start and stop codons are in bold in Table 13A.

**Table 13A. NOV13a nucleotide sequence (SEQ ID NO:27)**

<u>GCTTCTAGGCCTTCTCAGTAGATGGAGCTAAGTAATATATGTATATATACTAACCCACAG</u> <u>ATATAAATATGTCTATAATTATTCTATATTTATCCATTCGTGTATATGTTAAGATAAAC</u>
---

ATGATGGAGACCCCTTCAAATTTGCTTATGTTCTTTTTTCAGCCTATAGACCAGATATAATA  
 ATTAGCTTTTCTTCTCTTGAGATTCAGAGAGTCCTTATTTTCATATGTGCCTTCCAGA  
 ACATCTCTTGTGGTATTCACTACTTGGCTTCTGTGTTTCATGGGAGTCACCCCTCATCATG  
 TCTGCAGGCCCCCAGGCAATGTGAGTCAGGTTGTTTTCCATAATCACTCTAATTGGAGTT  
 TGGAGGACACCGGGGCTGTTGTCTTCAGGCCAGAAAGATTATGTTACGGTGCAGTTGC  
 AGAATGGTGGATCTGGGAGCTCTCAAGGTGTAGCAGGAATAAGAGGGAGAACACATCGA  
 GTTTGGGCTATGAATACACTGGCAGTAAGAAAGAGTTTCCTTGTGTGGATGGCTACATAT  
 ATGACCAGAACACATGGAAGCACTGCGGTGACCCAGTGAACCTGGTCTGTGACCGAA  
 AATGGCTTGCAATGCTGATCCAGCCCTATTTATGTTTGGAGTCCTACTGGGATCGGTGA  
 CTTTTGGCTACTTTTCTGACAGGCTAGGACGCCGGTGGTCTTGTGGGCCACAAGCAGTA  
 GCATGTTTTTGTGGAATAGCAGCGGCGTTTGCAGTTGATTATTACACCTTCATGGCTG  
 CTCGCTTTTTTCTTGCCATGGTTGCAAGTGGCTATCTTGTGGTGGGGTTTGTCTATGTGA  
 TGGAAATTCATTGGCATGAAGTCTCGGACATGGGCGTCTGTCCATTTGCATTCCTTTTTTG  
 CAGTTGGAACCCCTGCTGGTGGCTTTGACAGGATACTTGGTCAGGACCTGGTGGCTTTACC  
 AGATGATCCTCTCCACAGTGACTGTCCCCTTTATCCTGTGCTGTTGGGTGCTCCAGAGA  
 CACCTTTTTTGGCTTCTCTCAGAGGGACGATATGAAGAAGCACAAAAATAGTTGACATCA  
 TGGCCAAGTGAACAGGGCAAGCTCCTGTAACTGTGAGAACTTTTATCACTGGACCTAC  
 AAGGTCCTGTTAGTAATAGCCCCACTGAAGTTCAGAAGCACAACTATCATATCTGTTTT  
 ATAAGTGGAGCATTACGAAAAGGACACTTACCGTTTGGCTAATCTGGTTCCTGGAAGTT  
 TGGGATTCTACTCGTTTTCTTGAATTCTGTAACTTAGGAGGCAATGAATACTTAAACC  
 TCTTCCTCCTGGGTGTAGTGGAAATTCCTCGCTACACCTTCGTGTGCATCGCCATGGACA  
 AGGTCGGGAGGAGAACAGTCCCTGGCCTACTCTCTTTCTGCAGTGCCTGGCCTGTGGTG  
 TCGTTATGGTGATCCCCCAGAAACATTATATTTGGGTGTGGTGACAGCTATGGTTGGAA  
 AATTTGCCATCGGGGAGCATTGGCCTCATTTATCTTTATACAGCTGAGCTGTATCCAA  
 CCATTTGTAAGATCGCTGGCTGTGGGAAGCGGAGCATGGTGTGTCGCCTGGCCAGCATCC  
 TGGCGCCGTTCTCTGTGGACCTCAGCAGCATTGGATCTTCATACCACAGTTGTTTGTG  
 GGACTATGGCCCTCCTGAGTGGAGTGTAACTAAAGCTTCCAGAAACCCTTGGGAAAC  
 GGCTAGCAACTACTTGGGAGGAGGCTGCAAACTGGAGTCAGAGAATGAAAGCAAGTCAA  
 GCAAATTACTTCTCACAATAATAAGTGGGCTGGAAAAACGGAAGCGATTACCCCCA  
 GGGATTCTGCTTGGTGAATAAATGTGCCATGCCTGCTGTCTAGCACCTGAAATATTAT  
 TTACCCTAATGCCTTTGTATTAGAGGAATCTTATCTCATCTCCCATATGTTGTTTGTAT  
 GTCTTTTTAATAAATTTTGAAGAAAATTTAAAGCAAATATGTTATAAAAGAAATAAAA  
 ACTAAGATGAAAATCTCAGTTTAAAAA

The Organic Cation Transporter-like NOV13a disclosed in this invention maps to chromosome 6.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 411 of 682 bases (60%) identical to a gb:GENBANK-  
 5 ID:AB015050|acc:AB015050.1 mRNA from Homo sapiens (Homo sapiens mRNA for OCTN2, complete cds).

A disclosed NOV13a polypeptide (SEQ ID NO:28) encoded by SEQ ID NO:27 has 534 amino acid residues is presented in Table 13B using the one-letter code. NOV13a is likely a Type IIIa membrane protein (Ncyt Cexo) with an INTEGRAL Likelihood of -5.89 for  
 10 Transmembrane 229 - 245 (228 - 246), an INTEGRAL Likelihood of -5.10 for Transmembrane 376 - 392 (373 - 395), an INTEGRAL Likelihood of -4.57 for Transmembrane 171 - 187 (165 - 191), an INTEGRAL Likelihood of -4.51 for Transmembrane 348 - 364 (346 - 366), an INTEGRAL Likelihood of -3.08 for Transmembrane 205 - 221 (205 - 222), an INTEGRAL Likelihood of -3.03 for

Transmembrane 111 - 127 (108 - 129), an INTEGRAL Likelihood of -2.44 for Transmembrane 398 - 414 (397 - 415), an INTEGRAL Likelihood of -2.07 for Transmembrane 465 - 481 (465 - 481), an INTEGRAL Likelihood of -1.12 for Transmembrane 140 - 156 (140 - 156), and an INTEGRAL Likelihood of -0.59 for

- 5 Transmembrane 446 - 462 (446 - 463). The Psort and Hydropathy results predict that NOV13a has a signal peptide and is likely to be localized to the plasma membrane with a certainty of 0.6000. In an alternative embodiment, NOV13a is likely to be localized to the Golgi body with a certainty of 0.4000, or to the endoplasmic reticulum (membrane) with a certainty of 0.3000, or to the microbody (peroxisome) with a certainty of 0.3000.

**Table 13B. NOV13a protein sequence (SEQ ID NO:28)**

MGVTPHHVCRPPGNVSQVVFHNHNSNWSLEDTGALLSSGQKDYVTVQLONGEIWELSRCSR NKRENTSSLGYEYTGSKKEFPDVGYYDQNTWKSTAVTQWNLVCDRWLAMLIQPLFMF GVLLGSVTFGYFSDRLGRRVVLWATSSSMFLFGIAAAFAVDYTFMAARFFLAMVASGYL VVGFFVYVMEFIGMKSRTWASVHLHSFFAVGTLLVALTGVLVRTWWLYQMILSTVTVPFIL CCWVLPETPFWLLSEGRYEEAQKIVDIMAKWNRASSCKLSELLSLDLQGPVSNSPTEVQK HNLSYLFYNWSITKRTLTVWLIWFTGSLGFYSFSLNSVNLGGNEYLNLFLLGVEIPAYT FVCIAMDKVGRRTVLAYSLSFCSALACGVVMVIPQKHYILGVVTAMVGKFAIGAAGFLIYL YTAELYPTIVRSLAVGSGSMVCRLASILAPFSVDLSSIWIFIPQLFVGTMLLSGVLTLK LPETLGKRLATTWEEAAKLESENESSKSKLLLTNNSGLEKTEAITPRDSGLGE
--

- 10 The full amino acid sequence of the protein of the invention was found to have 430 of 430 amino acid residues (100%) identical to, and 430 of 430 amino acid residues (100%) similar to, the 456 amino acid residue ptnr:SPTREMBL-ACC:O14567 protein from Homo sapiens (Human) (WUGSC:RG33IP03.1 PROTEIN).

- 15 The Organic Cation Transporter disclosed in this invention is expressed in at least the following tissues: Liver, Spleen, germ cell, heart, lung, testis, b-cell. The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from: Cardiomyopathy, Atherosclerosis, Hypertension, Congenital heart defects,
- 20 Aortic stenosis, Atrial septal defect (ASD),Atrioventricular (A-V) canal defect, Ductus arteriosus , Pulmonary stenosis , Subaortic stenosis, Ventricular septal defect (VSD), valve diseases, Tuberosus sclerosis, Scleroderma, Obesity, Transplantation, Von Hippel-Lindau (VHL) syndrome, Cirrhosis, Hemophilia, Hypercoagulation, Idiopathic thrombocytopenic purpura , Immunodeficiencies, Graft versus host, Fertility, Systemic lupus erythematosus ,
- 25 Autoimmune disease, Asthma, Emphysema, Scleroderma, allergy, ARDS, and other diseases, disorders and conditions of the like.

## NOV13b

A disclosed NOV13b nucleic acid of 1666 nucleotides (also referred to as CG55988-02) (SEQ ID NO:29) encoding a novel Organic Cation Transporter-like protein is shown in Table 13C. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 76-78 and ending with a TAA codon at nucleotides 1654-1656. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined and the start and stop codons are in bold in Table 13C.

**Table 13C. NOV13b nucleotide sequence (SEQ ID NO:29)**

TTCCAGAGAGTCTCTATTTTCATATGTGCCTTCCAGAACATCTCTTGTGGTATTCACTAC  
TTGGCTTCTGTGTTTCATGGGAGTCACCCCTCATCATGTCTGCAGGCCCCAGGCAATGTG  
AGTCAGGTTGTTTTCCATAATCACTCTAATTGGAGTTTGGAGGACACCGGGGCCCTGTTG  
TCTTCAGGCCAGAAAGATTATGTTACGGTGCAGTTGCAGAATGGTGAATCTGGGAGCTC  
TCAAGGTGTAGCAGGAATAAGAGGGAGAACACATCGAGTTTGGGCTATGAATACTGGC  
AGTAAGAAAGAGTTTCTTGTGTGGATGGCTACATATATGACCAGAACACATGGAAAAGC  
ACTGCGGTGACCCAGTGGAACTGGTCTGTGACCGAAAATGGCTTGCAATGCTGATCCAG  
CCCCTATTTATGTTTGGAGTCTACTGGGATCGGTGACTTTTGGCTACTTTTCTGACAGG  
CTTTTTTGCCTATATGTGATTTGCAATGGGGTCAGACTCCTCAATAGTTATAAATGTGAC  
CTTGAATATAAATCCCTATTATTGTTTTTTCAGGTTGCAAGTGGCTATCTTGTGGTGGG  
TTTGTCTATGTGATGGAATTCATTGGCATGAAGTCTCGGACATGGGCGTCTGTCCATTG  
CATTCTTTTTTGCAGTTGGAACCTGCTGGTGGCTTTGACAGGATACTTGGTCAGGACC  
TGGTGGCTTTACCAGATGATCCTCTCCACAGTGACTGTCCCCTTTATCCTGTGCTGTTGG  
GTGCTCCCAGAGACACCTTTTTTGGCTTCTCTCAGAGGGACGATATGAAGAAGCACAAAA  
ATAGTTGACATCATGGCCAAGTGAACAGGGCAAGCTCCTGTAACTGTCAGAACTTTTA  
TCACTGGACCTACAAGGTCCTGTAGTAATAGCCCCACTGAAGTTCAGAAGCACAACTTA  
TCATATCTGTTTTATAACTGGAGCATTACGAAAAGGACACTTACCGTTTGGCTAATCTGG  
TTCACTGGAAGTTTGGGATTCTACTCGTTTTCTTGAATTCTGTAACTTAGGAGGCAAT  
GAATACTTAAACCTCTTCTCACAGGTGTAGTGGAATTCGCCCTACACCTTCGTGTGC  
ATCGCCATGGACAAGGTCGGGAGGAGAACAGTCTCGCCTACTCTCTTTTCTGCAGTGCA  
CTGGCCTGTGGTGTGTTATGGTGATCCCCAGGTGAGTTATCTTCTGGGTGTGGTGACA  
GCTATGGTTGGAATAATTGCCATCGGGGAGCATTGGCCTCATTTATCTTTATACAGCT  
GAGCTGTATCCAACATTGTAAGGTGCTGGCTGTGGGAAGCGGCAGCATGGTGTGTCGC  
CTGGCCAGCATCCTGGCGCCGTTCTGTGGACCTCAGCAGCATTTGGATCTTCATACCA  
CAGTTGTTTGTGGGACTATGGCCCTCCTGAGTGGAGTGTTAACACTAAAGCTTCCAGAA  
ACCCTTGGGAAACGGCTAGCAACTACTTGGGAGGAGGCTGCAAACTGGAGTCAGAGAAT  
GAAAGCAAGTCAAGCAAATTACTTCTCACAATAATAAGTGGGCTGGAAAAACGGAA  
GCGATTACCCCCAGGGATTCTGGTCTTGGTGAAT**TAA**TGTGCCATG

The Organic Cation Transporter-like NOV13b disclosed in this invention maps to chromosome 6.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 407 of 682 bases (59%) identical to a gb:GENBANK-ID:AB015050|acc:AB015050.1 mRNA from Homo sapiens (Homo sapiens mRNA for OCTN2, complete cds).

A disclosed NOV13b polypeptide (SEQ ID NO:30) encoded by SEQ ID NO:29 has 526 amino acid residues is presented in Table 13D using the one-letter code. NOV13b is

likely a Type IIIa membrane protein (Ncyt Cexo) with an INTEGRAL Likelihood of -5.89 for Transmembrane 221 - 237 (220 - 238), an INTEGRAL Likelihood of -5.10 for Transmembrane 368 - 384 (365 - 399), an INTEGRAL Likelihood of -4.94 for Transmembrane 161 - 177 (160 - 180), an INTEGRAL Likelihood of -3.08 for Transmembrane 197 - 213 (197 - 214), an INTEGRAL Likelihood of -3.03 for Transmembrane 111 - 127 (108 - 129), an INTEGRAL Likelihood of -2.13 for Transmembrane 340 - 356 (340 - 358), an INTEGRAL Likelihood of -2.07 for Transmembrane 390 - 406 (389 - 407), an INTEGRAL Likelihood of -2.07 for Transmembrane 457 - 473 (457 - 473), and an INTEGRAL Likelihood of -0.59 for Transmembrane 438 - 454 (438 - 455).

NOV13b PSORT results suggest that the organic cation transporter-like protein may be localized at the plasma membrane via a glycosyl phosphatidylinositol anchor typical of type III proteins. However, the protein of CuraGen Acc. No. CG55988-02 predicted here is similar to the transporter family, all members of which are localized to the plasma membrane with membrane-spanning segments. This prediction is also consistent with the results of the hydrophobicity analysis. Therefore it is likely that this novel organic cation transporter-like protein is localized to the plasma membrane with a certainty of 0.6000. In an alternative embodiment, NOV13a is likely to be localized to the Golgi body with a certainty of 0.4000, or to the endoplasmic reticulum (membrane) with a certainty of 0.3000, or to the microbody (peroxisome) with a certainty of 0.3000.

**Table 13D. NOV13b protein sequence (SEQ ID NO:30)**

<p>MGVTPHHVCRPPGNVSQVVFHNHNSWSLEDTGALLSSGQKDYVTVQLONGEIWELSRCSR  NKRENTSSLGYEYTGSKKEFPVCDGYIYDQNTWKSTAVTQWNLVCDRKLAMLIQPLFMF  GVLLGSVTFGYFSDRLFCLYVICNGVRLNLSYKCDLEYKSLLFVFQVASGYLVVGFVYVM  EFIGMKSRTWASVHLHSFFAVGTLTVALTGYLVRTWVLYQMILSTVTVPFILCCWVLPET  PFWLLSEGRYEEAQKIVDIMAKWNRASSCKLSELLSLDLQGPVSNSTPEVQKHNLSTYLFY  NWSITKRTLTWLIWFTGSLGFYSFSLNSVNLGGNEYLNLFITGVVEIPAYTFVCIAMDK  VGRRTVLAYSFLFCALACGVVMVIPQVSYLLGVVTAMVGKFAIGAAFGLIYLYTAELYPT  IVRSLAVGSGSMVCRLASILAPFSVDLSSIWIFIPQLFVGTMLLSGVLTCLKLPETLGKR  LATTWEEAAKLESENEKSSKLLLTNNSGLEKTEAITPRDSGLGE</p>
--

The full amino acid sequence of the protein of the invention was found to have 168 of 490 amino acid residues (34%) identical to, and 270 of 490 amino acid residues (55%) similar to, the 551 amino acid residue ptnr:SPTREMBL-ACC:O14546 protein from Homo sapiens (Human) (POLYSPECIFIC ORGANIC CATION TRANSPORTER).

The organic cation transporter-like gene disclosed in this invention is expressed in at least the following tissues: bone marrow, lymphoid tissue, testis, pituitary gland, pancreas, brain, liver and spleen. It is also expressed in the following disease conditions: anaplastic astrocytoma, colorectal carcinoma, ovarian serous adenocarcinoma, ovarian cystadenoma,



fibrillary astrocytoma, oligodendroglioma, pilocytic astrocytoma, breast cancer. It is upregulated in microvascular endothelial cells in response to vascular endothelial growth factor treatment. Furthermore, the sequence is predicted to be expressed in the following tissues because of the expression pattern of (GENBANK-ID: gb:GENBANK-

- 5 ID:AB015050|acc:AB015050.1) a closely related Homo sapiens mRNA for OCTN2, complete cds homolog in species Homo sapiens: kidney, skeletal muscle, heart, and placenta.

The nucleic acids and proteins of the invention have applications in the diagnosis and/or treatment of various diseases and disorders. For example, the compositions of the present invention will have efficacy for the treatment of patients suffering from: hemophilia, hypercoagulation, idiopathic thrombocytopenic purpura, autoimmune disease, allergies, immunodeficiencies, transplantation, graft versus host disease (GVHD), lymphoedema, fertility disorders, endocrine dysfunctions, diabetes, obesity, growth and reproductive disorders, Von Hippel-Lindau (VHL) syndrome, Alzheimer's disease, stroke, tuberous sclerosis, hypercalcaemia, Parkinson's disease, Huntington's disease, cerebral palsy, epilepsy, Lesch-Nyhan syndrome, multiple sclerosis, ataxia-telangiectasia, leukodystrophies, behavioral disorders, addiction, anxiety, pain, neurodegeneration, pancreatitis, cirrhosis, cancer, tissue degeneration, bacterial/viral/parasitic infections as well as other diseases, disorders and conditions.

20 NOV13a and NOV13b share a high degree of homology as is shown in the amino acid alignment in Table 13E.

Table 13E. Clustal W Alignment of NOV13a and NOV13b	
	10 20 30 40 50 60 70 80
CG55988_01	MGVTPHHVCRPPGNVSQVVFHNNHNSWSLEDTGALLSSGQKDYVTVOLQNGEIWELSRCSRNRKRENTSSLGVEYTGSKKEF
CG55988_02	MGVTPHHVCRPPGNVSQVVFHNNHNSWSLEDTGALLSSGQKDYVTVOLQNGEIWELSRCSRNRKRENTSSLGVEYTGSKKEF
	90 100 110 120 130 140 150 160
CG55988_01	PCVDGYIYDQNTWKSTAVTQWNLCVDRKWLAMLIQPLFMFGVLLGCVTFGYFSDRLGRRVVAATSSGHLFGIAAFAY
CG55988_02	PCVDGYIYDQNTWKSTAVTQWNLCVDRKWLAMLIQPLFMFGVLLGCVTFGYFSDRLGRRVVAATSSGHLFGIAAFAY
	170 180 190 200 210 220 230 240
CG55988_01	EVYVFAARFAMVASGYLVVGFVYVMEFIGMKSRWTASVHLHSFFAVGTLLVALTGYLVRTWNLQMLSTVTPFFIL
CG55988_02	EVYVFAARFAMVASGYLVVGFVYVMEFIGMKSRWTASVHLHSFFAVGTLLVALTGYLVRTWNLQMLSTVTPFFIL
	250 260 270 280 290 300 310 320
CG55988_01	CCWVLPETPFNLLSEGRYEEAKIVDIMAKWNRASSCKLSELLSLDLQGPVNSPTEVQKHNLSYLFYNWSITKRTLTVK
CG55988_02	CCWVLPETPFNLLSEGRYEEAKIVDIMAKWNRASSCKLSELLSLDLQGPVNSPTEVQKHNLSYLFYNWSITKRTLTVK
	330 340 350 360 370 380 390 400
CG55988_01	LWFTGSLGPFYSFSLNSVNLGGNEVNLFLTGVEIIPAYTFVCIAMDKVGRRTVLAYSLEFCSALACGVVWVIPQKHLG
CG55988_02	LWFTGSLGPFYSFSLNSVNLGGNEVNLFLTGVEIIPAYTFVCIAMDKVGRRTVLAYSLEFCSALACGVVWVIPQKHLG
	410 420 430 440 450 460 470 480
CG55988_01	VVTAVVGFAFGAAGFLIYLYTAELYPTIVRS LAVGSGSMVCR LASILAPFSVDLSSIWIFIPQLFVGTALLSGVLTLLK
CG55988_02	VVTAVVGFAFGAAGFLIYLYTAELYPTIVRS LAVGSGSMVCR LASILAPFSVDLSSIWIFIPQLFVGTALLSGVLTLLK
	490 500 510 520 530

CG55988\_01 LPETLGKRLATTWEEAAKLESENESSKSKLLLTNNSSGLEKTEAITPRDSGLGE  
CG55988\_02 LPETLGKRLATTWEEAAKLESENESSKSKLLLTNNSSGLEKTEAITPRDSGLGE

In a search of public sequence databases, NOV13 was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 13F.

**Table 13F. BLASTP results for NOV13**

Gene Index/ Identifier	Protein/Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SPTREMBL- ACC:Q96RU0	ORGANIC CATION TRANSPORTER OKB1 - Homo sapiens	577	533/534 (99%)	533/534 (99%)	7.2e-290
ptnr:SPTREMBL- ACC:O14567	WUGSC:RG331P03.1 PROTEIN - Homo sapiens	456	430/430 (100%)	430/430 (100%)	1.8e-236
ptnr:SPTREMBL- ACC:Q96M90	CDNA FLJ32744 FIS, CLONE TESTI2001420, WEAKLY SIMILAR TO D.MELANOGASTER PUTATIVE ORGANIC CATION TRANSPORTER - Homo sapiens	361	353/354 (99%)	353/354 (99%)	2.4e-188
ptnr:SPTREMBL- ACC:Q9UJ10	DJ261K5.1 (NOVEL ORGANIC CATION TRANSPORTER (BAC ORF RG331P03)) - Homo sapiens	305	305/305 (100%)	305/305 (100%)	2.9e-160
ptnr:SPTREMBL- ACC:Q9D5Z0	4921504E14RIK PROTEIN - Mus musculus	419	166/317 (52%)	219/317 (69%)	3.3e-88

- 5 A multiple sequence alignment is shown in Table 13G, with the protein of the inventin being shown on the first line in a ClustalW analysis comparing the protein of the invention with related protein sequences shown in Table 13F.

**Table 13G. ClustalW Analysis of NOV13**

1) NOV13a CG55988-01 (SEQ ID NO:28)	
2) Q96RU0 (SEQ ID NO:163)	
3) O14567 (SEQ ID NO:164)	
4) Q96M90 (SEQ ID NO:165)	
5) Q9UJ10 (SEQ ID NO:166)	
6) Q9D5Z0 (SEQ ID NO:167)	
	10 20 30 40 50 60 70 80
NOV13a	..... ..... ..... ..... ..... ..... ..... ..... ..... .....
Q96RU0	MGSRHFEGIYDVHGHFGRFQRVLYFICAFQNISCGIHYLASVFMGVTPHHVCRRPPGNVSQVVFHNHNSNWSLEDTGALLSS
O14567	----- ----- ----- ----- ----- ----- ----- ----- ----- -----
Q96M90	----- ----- ----- ----- ----- ----- ----- ----- ----- -----
Q9UJ10	----- ----- ----- ----- ----- ----- ----- ----- ----- -----
Q9D5Z0	----- ----- ----- ----- ----- ----- ----- ----- ----- -----
	90 100 110 120 130 140 150 160
NOV13a	GQKDYVTVQLQNGEIWELSRCSRNKRENTSSLGYEYTGSKKEFPQVDGYIYDQNTWKSTAVTQWNLCVDRKWLAMLIQPL
Q96RU0	GQKDYVTVQLQNGEIWELSRCSRNKRENTSSLGYEYTGSKKEFPQVDGYIYDQNTWKSTAVTQWNLCVDRKWLAMLIQPL
O14567	GQKDYVTVQLQNGEIWELSRCSRNKRENTSSLGYEYTGSKKEFPQVDGYIYDQNTWKSTAVTQWNLCVDRKWLAMLIQPL
Q96M90	----- ----- ----- ----- ----- ----- ----- ----- ----- -----
Q9UJ10	----- ----- ----- ----- ----- ----- ----- ----- ----- -----
Q9D5Z0	----- ----- ----- ----- ----- ----- ----- ----- ----- -----
	170 180 190 200 210 220 230 240
	..... ..... ..... ..... ..... ..... ..... ..... ..... .....

[illegible]

**Table 13H. Patp BLASTP Analysis for NOV13**





When expressed in oocytes, rOCT1 stimulated uptake of TEA, which was inhibited by diverse organic cations. Electrophysiological experiments using rOCT1-expressing oocytes under voltage-clamped conditions demonstrated that positive inward currents were induced when TEA, NMN, choline, dopamine, or MPP were added to the bath medium, indicating that rOCT1-mediated cation uptake is electrogenic.

Human (h) OCT1 is comprised of 554 amino acids and shows 78% identity with rOCT1. Its mRNA transcript was detected exclusively in the liver. There are distinct species differences in tissue distribution and histochemical localization of OCT1. After expression in oocytes, hOCT1 mediated the uptake of type 1 organic cations such as NMN, TEA, and MPP, suggesting that hOCT1 may primarily participate in hepatic excretion of organic cations in humans. hOCT1-mediated MPP uptake was saturable with a  $K_m$  value of 14.6 mmol/L and was sensitive to transmembrane potential. The type 2 hydrophobic cations such as vecuronium and decynium-22 as well as the type 1 hydrophilic cations such as TEA and NMN inhibited MPP uptake. hOCT1 has lower binding affinity for several cations such as decynium-22, tetrapentylammonium, quinine, and NMN than rOCT1, indicating species differences in the substrate specificity. The human genes of hOCT1 and hOCT2 (also named SLC22A1 and SLC22A2) have been localized in close proximity on chromosome 6q26.

Since OCT1 was cloned, other gene products with significant homology to OCT1 have been identified. Using hybridization techniques, we isolated a cDNA encoding OCT2 from rat kidney. rOCT2 is comprised of 593 amino acids with 12 proposed putative transmembrane domains showing a 67% identity to rOCT1. On Northern hybridization and RT-PCR analysis, the rOCT2 mRNA transcript was detected predominantly in the kidney, at higher levels in the medulla than the cortex, but not in the liver, lung, or intestine. When rOCT2 was expressed in oocytes, uptake of TEA was suppressed by the replacement of  $\text{Na}^+$  with  $\text{K}^+$ , suggesting that the uptake was membrane potential-dependent. Acidification of extracellular medium resulted in a decreased uptake of TEA, whereas the efflux of TEA out of rOCT1- and rOCT2-expressing oocytes was not stimulated by the inward  $\text{H}^+$  gradient. To compare the functional characteristics of rOCT1 and rOCT2, we established stable transfectants using MDCK cells. TEA uptake by both rOCT1 and rOCT2 transfectants grown on microporous membrane filters was markedly enhanced when TEA was added to the basolateral bath medium, but not to the apical medium. TEA uptake by both transfectants was decreased by acidifying the medium pH, suggesting that rOCT1- and rOCT2-mediated TEA transport were pH sensitive. Efflux of TEA out of the transfectants was unaffected or moderately inhibited by acidification of the medium. Structurally diverse organic cations, including the type 1 cations such as MPP,

cimetidine, NMN, nicotine, and procainamide, and type 2 cations, such as quinine and quinidine, inhibited TEA uptake in the transfectants. Inhibition experiments suggested that rOCT1 and rOCT2 had similar inhibitor binding affinities for many compounds, but showed moderate differences in inhibitor sensitivity for several compounds such as MPP,  
5 procainamide, dopamine, and testosterone by a factor of 2 to 3. rOCT2 and hOCT2, which share 80% amino acid identity, have been shown to accept monoamine neurotransmitters such as dopamine, norepinephrine, epinephrine, 5-hydroxytryptamine, and amantadine as substrates. These findings raise the possibility that OCT2 plays a physiological role in renal handling of some bioactive monoamines and implies that the transporter is indirectly involved  
10 in the physiological function of these monoamines such as renal tubular reabsorption of Na<sup>+</sup>.

Recently, it was reported that slices and isolated basolateral membrane vesicles of male rat kidney showed a higher transport activity for TEA than those of female rat kidney. The expression levels of rOCT2 mRNA and the protein in the kidney of males were much higher than those in females. There was no gender difference in mRNA expression levels of rOCT1.  
15 These findings suggested that rOCT2 is responsible for the gender differences in renal basolateral membrane organic cation transport activity.

A cDNA encoding an additional member of the OCT gene family, designated as OCT3, was isolated from the rat placenta. rOCT3 is comprised of 551 amino acids with 12 putative transmembrane domains and shows 48% identity to rOCT1. Northern blot analysis  
20 indicated that rOCT3 mRNA was detected most abundantly in the placenta and moderately in the intestine, heart, and brain. Expression of rOCT3 mRNA was comparatively low in the kidney and lung, and it was not detected in the liver. When expressed in HeLa cells and *Xenopus* oocytes, rOCT3 induced uptake of TEA and guanidine, which could be inhibited by MPP. Under voltage-clamped conditions, rOCT3-mediated TEA uptake evoked a potential-  
25 dependent inward current. The current induced by the TEA uptake was markedly influenced by extracellular pH. However, such pH dependence of TEA uptake by rOCT3-expressing oocytes could not be confirmed under voltage clamp conditions. Therefore, rOCT3 appears to be a potential-sensitive and pH gradient-independent organic cation transporter. Although the distribution and localization of rOCT3 in the kidney have not yet been determined, it may also  
30 participate in the renal handling of a variety of organic cations.

By their homology to OCT transporters, two additional members of the OCT gene family, named hOCTN1 (SLC22A4) and hOCTN2 (SLC22A5), have been identified. A cDNA encoding hOCTN1 was cloned from human fetal liver and encodes 551 amino acid residue protein with 11 putative transmembrane domains and one nucleotide binding site

motif. hOCTN1 mRNA was found to be abundant in the kidney, trachea, bone marrow, fetal liver and several human cancer cell lines, but not in adult liver. When expressed in HEK293 cells, hOCTN1 mediated saturable and pH-dependent uptake of TEA with higher activity at neutral and alkaline than at acidic pH. In addition, the efflux of TEA out of the cells was pH-dependent, with an accelerated rate at acidic external medium pH. TEA uptake was not influenced by membrane potential, and hOCTN1-mediated TEA uptake was inhibited by other organic cations such as cimetidine, procainamide, quinidine, quinine, and verapamil. When expressed in oocytes, hOCTN1 stimulated uptake of quinidine, verapamil, and zwitterionic L-carnitine. The functional role of OCTN1 in the renal secretion of organic cations remains unknown.

hOCTN2 was identified as a homologue of hOCTN1 from human kidney. hOCTN2 cDNA encodes a 557-amino acid residue protein with 76% similarity to hOCTN1. hOCTN2 is strongly expressed in the kidney, trachea, spleen, bone marrow, skeletal muscle, heart, and placenta in adult humans. When expressed in HEK293 cells, hOCTN2 mediated the uptake of L-carnitine in a Na<sup>+</sup>-dependent manner with a K<sub>m</sub> value of 4.3 mmol/L, whereas it mediated some minor uptake of TEA and guanidine. The physiological function of hOCTN2 is suggested to be a high-affinity Na<sup>+</sup>-carnitine cotransporter. It was reported that primary systemic carnitine deficiency, which is an autosomal recessive disease characterized by low serum and intracellular concentrations of carnitine, is caused by mutations in the hOCTN2 gene.

Interestingly, it was recently reported that rOCTN2 is a Na<sup>+</sup>-independent organic cation transporter as well as a Na<sup>+</sup>-dependent carnitine transporter, which is expressed in the heart, kidney, placenta, and brain. In rat kidney, rOCTN2 mRNA is predominantly expressed in the cortex, while there is very little expression in the medulla. In the cortical region, rOCTN2 mRNA was found in the proximal and distal tubules. There have been two mutations reported that result in amino acid substitution in OCTN2, P478L (hOCTN2) and L352R (mouse OCTN2). These mutations in hOCTN2 cause complete loss of carnitine transport function. In contrast, only the M352R mutant appeared to be associated with complete loss of organic cation transport function, whereas the P478L mutant had higher organic cation transport activity than the wild-type transporter. These studies suggested that the binding sites for carnitine and organic cations in OCTN2 exhibit significant overlap but are not identical. Therefore, there may be clinical implications for pharmacotherapy in individual patients with primary carnitine deficiency if the mutations in OCTN2 also affect organic cation transport activity.



The organic cation transporter family is critical in the elimination of many endogenous amines as well as drugs and environmental toxin. Members of this family are usually expressed in the kidney, liver and small intestine. Gründemann et al (*Nature* 372: 549-552, 1994) identified the first member of the organic cation transporter family, designated as OCT1, from the rat kidney by expression cloning. rOCT1 is comprised of 556 amino acids with 12 putative transmembrane domains and is expressed in the liver, kidney, intestine and colon. When expressed in oocytes, rOCT1 stimulated uptake of TEA, which was inhibited by diverse organic cations. Electrophysiological experiments using rOCT1-expressing oocytes under voltage-clamped conditions demonstrated that positive inward currents were induced when TEA, NMN, choline, dopamine, or MPP were added to the bath medium, indicating that rOCT1-mediated cation uptake is electrogenic.

Human hOCT1 is comprised of 554 amino acids and shows 78% identity with rOCT1 (Zhang et al., *Molec. Pharm.* 51: 913-921, 1997). Its mRNA transcript was detected exclusively in the liver. There are distinct species differences in tissue distribution and histochemical localization of OCT1. After expression in oocytes, hOCT1 mediated the uptake of type 1 organic cations such as NMN, TEA, and MPP, suggesting that hOCT1 may primarily participate in hepatic excretion of organic cations in humans. hOCT1 seems to differ in its substrate specificity relative to rOCT1. The human genes of hOCT1 and hOCT2 (also named SLC22A1 and SLC22A2) have been localized in close proximity on chromosome 6q26.

Since OCT1 was cloned, other gene products with significant homology to OCT1 have been identified. rOCT2, isolated from rat kidney, has a 67% identity to rOCT1 (Okuda et al., *Biochem Biophys Res Commun* 224(2):500-7, 1996). It is detected predominantly in the kidney, at higher levels in the medulla than the cortex, but not in the liver, lung, or intestine. rOCT2 seems to play a physiological role in renal handling of some bioactive monoamines. A cDNA encoding an additional member of the OCT gene family, designated as OCT3, was isolated from the rat placenta (Kekuda et al., *J Biol Chem* 273(26):15971-9, 1998). rOCT3 is comprised of 551 amino acids with 12 putative transmembrane domains and shows 48% identity to rOCT1. Northern blot analysis indicated that rOCT3 mRNA was detected most abundantly in the placenta and moderately in the intestine, heart, and brain. Expression of rOCT3 mRNA was comparatively low in the kidney and lung, and it was not detected in the liver. rOCT3 is a potential-sensitive and pH gradient-independent organic cation transporter.

By their homology to OCT transporters, two additional members of the OCT gene family, named hOCTN1 (SLC22A4; Tamai et al., *FEBS Lett* 419(1):107-11, 1997) and

hOCTN2 (SLC22A5; Wu et al., *Biochem Biophys Res Commun* 246(3):589-95, 1998) have also been identified. hOCTN1 mRNA was found to be abundant in the kidney, trachea, bone marrow, fetal liver and several human cancer cell lines, but not in adult liver. hOCTN2 is strongly expressed in the kidney, trachea, spleen, bone marrow, skeletal muscle, heart, and placenta in adult humans. The physiological function of hOCTN2 is suggested to be a high-affinity Na<sup>+</sup>-carnitine cotransporter. It has been reported that primary systemic carnitine deficiency, an autosomal recessive disease characterized by low serum and intracellular concentrations of carnitine, is caused by mutations in the hOCTN2 gene (Wang et al., *Hum Mutat* 16(5):401-7, 2000).

**NOV14**

NOV14 includes two novel D-beta Hydroxybutyrate Dehydrogenase-like proteins disclosed below. The disclosed sequences have been named NOV14a and NOV14b. Unless specifically addressed as NOV14a or NOV14b, any reference to NOV14 is assumed to encompass all variants.

**NOV14a**

A disclosed NOV14a nucleic acid of 1192 nucleotides (also referred to as CG56001-01) (SEQ ID NO:31) encoding a novel D-beta-hydroxybutyrate dehydrogenase-like protein is shown in Table 14A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 69-71 and ending with a TGA codon at nucleotides 1098-1100. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined. The start and stop codons are in bold in Table 14A.

Table 14A. NOV14a nucleotide sequence (SEQ ID NO:31)	
<u>TGCTGAGGGTGCATT</u> TATGTTTCAGAACCA	CGGGAGGA <b>ACTGGGCCATTCTAACACCCG</b>
<u>TTGCTACCA</u> <b>TGCTGGCCACCCGCCTCTCCAGACCCCTGTCACGGCTCCCAGGAAAAACCC</b>	
<u>TAAGTGCC</u> TGTGATAGAGAAAATGGAGCAAGGCGCCCACTATTGCTTGGTTCTACTTCCT	
<u>TTATCCCGATTGGCCGTCGGACTTATGCCAGTGCGGCGGAGCCGTGAGTGGA</u> AAAGCTG	
<u>TCCTGGTCACAGGCTGTGACTCTGGATT</u> TGGGTTCTCATTGGCCAAGCATCTGCATTCAA	
<u>AAGGCTTCCTTGTGTTGCTGGCTGCTTGATGAAGGACAAAGGCCATGATGGGGTCAAGG</u>	
<u>AGCTGGACAGCCTAAACAGTGACCGATTGAGAACCGTCCAGCTCAATGTCTGCAGCAGCG</u>	
<u>AAGAGGTGGAGAAAGTGGTGGAGATTGTCCGCTCGAGCCTGAAGGACCCTGAGAAAGGTA</u>	
<u>TGTGGGGCCTCGTTAA</u> CAATGCCGGCATCTCAACGTTTCGGGGAGGTGGAGTTCAACAGCC	
<u>TGGAGACCTACAAGCAGGTGGCAGAAGTGAACCTTTGGGGCACAGTGCGGATGACGAAAT</u>	
<u>CCTTTCTCCCCCTCATCCGAAGGGCCAAAGGTCGCGTCGTCAATATCAGCAGCATGCTGG</u>	
<u>GCCGCGATGGCCAACCCGGCCCGCTCCCCGTACTGCATACCAAGTTCGGGGTAGAGGCTT</u>	
<u>TCTCGGACTGCCTGCGCTATGAGATGTACCCCTGGGCGTGAAGGTCAGCGTGGTGGAGC</u>	
<u>CCGGCAACTTCATCGCTGCCACCAGCCTTTACAGCCCTGAGAGCATT</u> CAGGCCATCGCCA	
<u>AGAAGATGTGGGAGGAGCTGCCTGAGGTCGTGCGCAAGGACTACGGCAAGAAGTACTTTG</u>	
<u>ATGAAAAGATCGCCAAGATGGAGACCTACTGCAGCAGTGGCTCCACAGACACGTCCCCTG</u>	

TCATCGATGCTGTACACACGCCCTGACCGCCACCACCCCTACACCCGCTACCACCCCA  
TGGACTACTACTGGTGGCTGCGAATGCAGATCATGACCCACTTGCCTGGAGCCATCTCCG  
ACATGATCTACATCCGCTGAAGAGTCTCGCTGTGGCCTCTGTGAGGATCCCTGGTGGAA  
GGGGAGGGGAGGGAGGAACCCATATAGTCAACTCTTGATTATCCACGTGTGG

The human D-beta-hydroxybutyrate dehydrogenase-like NOV14a disclosed in this invention maps to chromosome 3.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 958 of 1145 bases (83%) identical to a gb:GENBANK-  
5 ID:RATDBHYDEH|acc:M89902.1 mRNA from Rattus norvegicus (Sprague-Dawley D-beta-hydroxybutyrate dehydrogenase mRNA, complete cds).

A disclosed NOV14a polypeptide (SEQ ID NO:32) encoded by SEQ ID NO:31 has 343 amino acid residues and is presented in Table 14B using the one-letter code. Although SignalP suggests that the human D-beta-hydroxybutyrate dehydrogenase may have a signal peptide, Psort predicts that it is localized in to mitochondria. Because it is similar to the  
10 human hydroxybutyrate dehydrogenase family, some members of which are expected to have mitochondrial localization. Therefore it is likely that this novel human D-beta-hydroxybutyrate dehydrogenase is available at the same sub-cellular localization and hence accessible to a diagnostic probe and for various therapeutic applications. Nonetheless, the SignalP, Psort  
15 and/or Hydropathy results predict that NOV14a is likely to be localized to the mitochondrial matrix space with a certainty of 0.6723. In an alternative embodiment, NOV14 is likely to be localized to the microbody (peroxisome) with a certainty of 0.3942, or to the mitochondrial inner membrane with a certainty of 0.3622, or to the mitochondrial intermembrane space with a certainty of 0.3622. According to SignalP data the most likely cleavage site is between  
20 amino acids 12 and 13, i.e., at the dash in the sequence LSR-LP.

**Table 14B. NOV14a protein sequence (SEQ ID NO:32)**

MLATRLSRPLSRLPGKTLSDRENGARRPLLLGSTSFIPIGRRTYASAAEPVSGKAVLV  
TGCDSGFGFSLAKHLHSGFLVFAGCLMKDKGHDGVKELDSLNSDRLRTVQLNVCSSSEV  
EKVVEIVRSSLKDPEKGMWGLVNNAGISTFGEVEFTSLETYKQVAEVLNWTVRMTKSFL  
PLIRRAKGRVVNISSMLGRMANPARSPYCITKFGVEAFSDCLRYEMYPLGVKVSVEPGN  
FIAATSLYSPESIQAIKKMWEELPEVVRKDYGKKYFDEKIAKMETYCSSGSTDTSPVID  
AVTHALTATTPYTRYHPMDYYWLRMQIMTHLPGAISDMIYIR

The full amino acid sequence of the protein of the invention was found to have 297 of 342 amino acid residues (86%) identical to, and 313 of 342 amino acid residues (91%) similar to, the 344 amino acid residue ptnr:SWISSPROT-ACC:P29147 protein from Rattus

norvegicus (Rat) (D-BETA-HYDROXYBUTYRATE DEHYDROGENASE PRECURSOR (EC 1.1.1.30) (BDH) (3-HYDROXYBUTYRATE DEHYDROGENASE)).

The human D-beta-hydroxybutyrate dehydrogenase disclosed in this invention is expressed in at least the following tissues: brain, eye, colon, kidney, liver, spleen, lung, breast, ovary, testis, genitourinary track, lymph, T-cell, B-cell. In addition, the sequence is predicted to be expressed in the heart because of the expression pattern of (GENBANK-ID: gb:GENBANK-ID:RATDBHYDEH|acc:M89902.1) a closely related Sprague-Dawley D-beta-hydroxybutyrate dehydrogenase mRNA, complete cds homolog in species Rattus norvegicus.

The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from diabetes, obesity, and other diseases, disorders and conditions of the like.

#### NOV14b

A disclosed NOV14b nucleic acid of 1166 nucleotides (also referred to as CG56001-02) (SEQ ID NO:33) encoding a novel D-beta-hydroxybutyrate dehydrogenase-like protein is shown in Table 14C. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 69-71 and ending with a TGA codon at nucleotides 1098-1100. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined. The start and stop codons are in bold in Table 14C.

**Table 14C. NOV14b nucleotide sequence (SEQ ID NO:33)**

TGCTGAGGGTGCATTTATGTTTCAGAACCACCGGGAGGAACTGGGCCATTCTAACACCCG  
TTGCTACCATGCTGGCCACCCGCCTCTCCAGACCCCTGTCACGGCTCCCAGGAAAAACCC  
TAAGTGCTGTGATAGAGAAAATGGAGCAAGACGCCCATTATTGCTTGGTTCTACTTCCT  
TTATCCCGATTGGCCGTCGGACTTATGCCAGTGCGGCGGAGCCGTTGGCAGCAAAGCTG  
TCCTGGTCACAGGCTGTGACTCTGGATTTGGGTTCTCATTGGCCAAGCATCTGCATTCAA  
AAGGCTTCCTTGTGTTTCTGGCTGCTTGATGAAGGACAAAGGCCATGATGGGGTCAAGG  
AGCTGGACAGCCTAAACAGTGACCGATTGAGAACCGTCCAGCTCAATGTCTGCAGCAGCG  
AAGAGGTGGAGAAAGTGGTGGAGATTGTCCGCTCGAGCCTGAAGGACCCTGAGAAAGGCA  
TGTGGGGCCTCGTTAACAATGCCGGCATCTCAACGTTGCGGGAGGTGGAGTTCACCAGCC  
TGGAGACCTACAAGCAGGTGGCAGAAAGTGAACCTTTGGGGCACAGTGCGGATGACGAAAT  
CCTTTCTCCCCCTCATCCGAAGGGCCAAAGGCCGCTCGTCAATATCAGCAGCATGCTGG  
GCCGCATGGCCAACCCGGCCCGCTCCCCGTACTGCATCACCAGTTCGGGGTAGAGGCTT  
TCTCGGACTGCCTGCGCTATGAGATGTACCCCTGGGCGTGAAGGTACGCGTGGTGGAGC  
CCGGCAACTTCATCGCTGCCACCAGCCTTTACAGCCCTGAGAGCATTAGGCCATCGCCA  
AGAAGATGTGGGAGGAGCTGCCTGAGGTGCTGCGCAAGGACTACGGCAAGAAGTACTTTG  
ATGAAAAGATCGCCAAGATGGAGACCTACTGCAGCAGTGGCTCCACAGACACGTCCCCTG  
TCATCGATGCTGTACACACGCCCTGACCGCCACCACCCCTACACCCGCTACCACCCCA  
TGGACTACTACTGGTGGCTGCGAATGCAGATCATGACCACTTGCCCTGGAGCCATCTCCG  
ACATGATCTACATCCGCTGAAGAGTCTCGCTGTGGCCTCTGTGAGGGATTCTTGGTGGAA  
GGGGAGGGGAGGGAGGAACCCATATA

The human D-beta-hydroxybutyrate dehydrogenase-like NOV14b disclosed in this invention maps to chromosome 3.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 933 of 1108 bases (84%) identical to a gb:GENBANK-  
5 ID:RATDBHYDEH|acc:M89902.1 mRNA from Rattus norvegicus (Sprague-Dawley D-beta-hydroxybutyrate dehydrogenase mRNA, complete cds).

A disclosed NOV14b polypeptide (SEQ ID NO:34) encoded by SEQ ID NO:33 has 343 amino acid residues and is presented in Table 14D using the one-letter code. SignalP, Psort and/or Hydropathy results predict that NOV14a is likely to be localized to the  
10 mitochondrial matrix space with a certainty of 0.6723. In an alternative embodiment, NOV14 is likely to be localized to the microbody (peroxisome) with a certainty of 0.3942, or to the mitochondrial inner membrane with a certainty of 0.3622, or to the mitochondrial intermembrane space with a certainty of 0.3622. According to SignalP data the most likely cleavage site is between amino acids 12 and 13, i.e., at the dash in the sequence LSR-LP.

**Table 14D. NOV14b protein sequence (SEQ ID NO:34)**

MLATRLSRPLSRPLPGKTLSDRENGARRPLLLGSTSFPIGRRTYASAAEPVGSKAVLV TGCDSGFGFSLAKHLHSGFLVFAGCLMKDKGHDGVKELDSLNSDRLRTVQLNVCSSEEV EKVVEIVRSSLKDPEKGMWGLVNNAGISTFGEVEFTSLETYKQVAEVLWGTVRMTKSFL PLIRRAKGRVNNISSMLGRMANPARSPYCITKFGVEAFSDCLRYEMYPLGVKVSVEPGN FIAATSLYSPESIQAIKKMWEELPEVVRKDYGKKYFDEKIAKMETYCSSGSTDTSPVID AVTHALTATTPYTRYHPMDYYWLRMQIMTHLPGAISDMIYIR
--

15 The full amino acid sequence of the protein of the invention was found to have 331 of 344 amino acid residues (96%) identical to, and 333 of 344 amino acid residues (96%) similar to, the 344 amino acid residue ptnr:SWISSNEW-ACC:Q02338 protein from Homo sapiens (Human) (D-BETA-HYDROXYBUTYRATE DEHYDROGENASE PRECURSOR (EC 1.1.1.30) (BDH) (3-HYDROXYBUTYRATE DEHYDROGENASE)).

20 The D-BETA-HYDROXYBUTYRATE DEHYDROGENASE PRECURSOR-like gene disclosed in this invention is expressed in at least the following tissues: brain, eye, colon, kidney, liver, spleen, lung, breast, ovary, testis, genitourinary track, lymph, T-cell, B-cell. Expression information was derived from the tissue sources of the sequences that were included in the derivation of the sequence of CuraGen Acc. No. CG56001-02. The sequence is  
25 predicted to be expressed in the following tissues because of the expression pattern of (GENBANK-ID: gb:GENBANK-ID:RATDBHYDEH|acc:M89902.1) a closely related Sprague-Dawley D-beta-hydroxybutyrate dehydrogenase mRNA, complete cds homolog in species Rattus norvegicus :heart.

The nucleic acids and proteins of the invention have applications in the diagnosis and/or treatment of various diseases and disorders. For example, the compositions of the present invention will have efficacy for the treatment of patients suffering from: diabetes, obesity as well as other diseases, disorders and conditions.

5           NOV14a and NOV14b share a high degree of homology as is shown in the amino acid alignment in Table 14E.

Table 14E. Clustal W Alignment of NOV14a and NOV14b	
	10           20           30           40           50           60           70           80
CG56001_01	MLATRLSRPLSRPLPGKTLACDRENGARRPLLGGSTSFIPIGRRTYASAAEPVSGKAVLVTGCDSGFGFSLAKHLHSGKF
CG56001_02	MLATRLSRPLSRPLPGKTLACDRENGARRPLLGGSTSFIPIGRRTYASAAEPVSGKAVLVTGCDSGFGFSLAKHLHSGKF
	90           100           110           120           130           140           150           160
CG56001_01	LVFAGCLMKDKGHDGVKELDSLNSDLRLRTVQLNVCSSEBEVKVVEIVRSSLKDPEKGMGLVNNAGISTFGEVEFTSLET
CG56001_02	LVFAGCLMKDKGHDGVKELDSLNSDLRLRTVQLNVCSSEBEVKVVEIVRSSLKDPEKGMGLVNNAGISTFGEVEFTSLET
	170           180           190           200           210           220           230           240
CG56001_01	YKQVAEVLNLTGTVRMTKSFPLIRRAKGRVVNISSMLGRMANPARSPYCITKFGVEAFSDCLRYEMYPLGVKVSVEPQGN
CG56001_02	YKQVAEVLNLTGTVRMTKSFPLIRRAKGRVVNISSMLGRMANPARSPYCITKFGVEAFSDCLRYEMYPLGVKVSVEPQGN
	250           260           270           280           290           300           310           320
CG56001_01	FIAATSLYSPESIQATAKKMWELPEVVRKDYGKKYFDEKIAKMETVCSSGSTDTSPVIDAVTHALTATTPYTRYHPMDY
CG56001_02	FIAATSLYSPESIQATAKKMWELPEVVRKDYGKKYFDEKIAKMETVCSSGSTDTSPVIDAVTHALTATTPYTRYHPMDY
	330           340
CG56001_01	YVWLRMQIMTHLPGAISDMIYIR
CG56001_02	YVWLRMQIMTHLPGAISDMIYIR

In a search of public sequence databases, NOV14 was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 14F.

Table 14F. BLASTP results for NOV14
-------------------------------------

Gene Index/ Identifier	Protein/Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SPTREMBL- ACC:Q9BRZ4	HYPOTHETICAL 38.2 KDA PROTEIN - Homo sapiens	343	341/343 (99%)	341/343 (99%)	2.0e- 182
ptnr:SPTREMBL- ACC:Q96ET1	UNKNOWN (PROTEIN FOR MGC:9788) - Homo sapiens	343	340/343 (99%)	341/343 (99%)	4.2e- 182
ptnr:SWISSNEW- ACC:Q02338	D-beta-hydroxybutyrate dehydrogenase, mitochondrial precursor (EC 1.1.1.30) (BDH) (3- hydroxybutyrate dehydrogenase) - Homo sapiens	344	329/344 (95%)	331/344 (96%)	1.0e- 173
ptnr:pir- id:A42845	3-hydroxybutyrate dehydrogenase (EC 1.1.1.30) - human	343	319/333 (95%)	321/333 (96%)	1.1e- 169
ptnr:SWISSNEW- ACC:P29147	D-beta-hydroxybutyrate dehydrogenase, mitochondrial precursor (EC 1.1.1.30) (BDH) (3- hydroxybutyrate dehydrogenase) - Rattus norvegicus	344	297/342 (86%)	313/342 (91%)	3.6e- 160

A multiple sequence alignment is shown in Table 14G, with the protein of the invention being shown on the first line in a ClustalW analysis comparing the protein of the invention with related protein sequences shown in Table 14F.

**Table 14G. ClustalW Analysis of NOV14**

1) NOV14a CG56001-01	(SEQ ID NO:31)
2) Q9BRZ4	(SEQ ID NO:171)
3) Q96ET1	(SEQ ID NO:172)
4) Q02338	(SEQ ID NO:173)
5) A42845	(SEQ ID NO:174)
6) P29147	(SEQ ID NO:175)

	10	20	30	40	50	60	70	80
NOV14a	.....	.....	.....	.....	.....	.....	.....	.....
Q9BRZ4	.....	.....	.....	.....	.....	.....	.....	.....
Q96ET1	.....	.....	.....	.....	.....	.....	.....	.....
Q02338	.....	.....	.....	.....	.....	.....	.....	.....
A42845	.....	.....	.....	.....	.....	.....	.....	.....
P29147	.....	.....	.....	.....	.....	.....	.....	.....

	90	100	110	120	130	140	150	160
NOV14a	.....	.....	.....	.....	.....	.....	.....	.....
Q9BRZ4	.....	.....	.....	.....	.....	.....	.....	.....
Q96ET1	.....	.....	.....	.....	.....	.....	.....	.....
Q02338	.....	.....	.....	.....	.....	.....	.....	.....
A42845	.....	.....	.....	.....	.....	.....	.....	.....
P29147	.....	.....	.....	.....	.....	.....	.....	.....

	170	180	190	200	210	220	230	240
NOV14a	.....	.....	.....	.....	.....	.....	.....	.....
Q9BRZ4	.....	.....	.....	.....	.....	.....	.....	.....
Q96ET1	.....	.....	.....	.....	.....	.....	.....	.....
Q02338	.....	.....	.....	.....	.....	.....	.....	.....
A42845	.....	.....	.....	.....	.....	.....	.....	.....
P29147	.....	.....	.....	.....	.....	.....	.....	.....

	250	260	270	280	290	300	310	320
NOV14a	.....	.....	.....	.....	.....	.....	.....	.....
Q9BRZ4	.....	.....	.....	.....	.....	.....	.....	.....
Q96ET1	.....	.....	.....	.....	.....	.....	.....	.....
Q02338	.....	.....	.....	.....	.....	.....	.....	.....
A42845	.....	.....	.....	.....	.....	.....	.....	.....
P29147	.....	.....	.....	.....	.....	.....	.....	.....





```

vaGlnvgvpglSaYsASKaavigltrsLAlElaphgtgIrVnavaPGGvd
+ |+ +++|++|+|+ +|++|++++++|+ |++| | ++|++| | | +
196 MLGR-MANPARSPYCITKFGVEAFSDCLRYEMYPLG--VKVSVVEPGNFI 242

T..dmtkalrsrlieakkk.v.re.v.adiadpeleerits.titplgry
+++ + + |++|++++ +| |++|+ +++++|+|++ ++ ++ +
243 AatSLYSPESIQAI AKMWeElPEvVrKDYGKKYFDEKIAKMeT-YCSSG 291

gvtpeeianavlfLasdgasys.....vtgqtlInvdggl<--*
++ + + +|| + +++ +|++ ++ + ++ +++++ |++
292 STDTSPVIDAVTHALTATTPYTryhpmddywwlRMQIMTHLPGAI 336

```

The short-chain dehydrogenases/reductases family (SDR) is a very large family of enzymes, most of which are known to be NAD- or NADP-dependent oxidoreductases. As the first member of this family to be characterized was *Drosophila* alcohol dehydrogenase, this family used to be called 'insect-type', or 'short-chain' alcohol dehydrogenases. Most members of this family are proteins of about 250 to 300 amino acid residues. Most dehydrogenases possess at least two domains, the first binding the coenzyme, often NAD, and the second binding the substrate. This latter domain determines the substrate specificity and contains amino acids involved in catalysis. Little sequence similarity has been found in the coenzyme binding domain although there is a large degree of structural similarity, and it has therefore been suggested that the structure of dehydrogenases has arisen through gene fusion of a common ancestral coenzyme nucleotide sequence with various substrate specific domains.

This family should always be found adjacent to [INTERPRO:IPR002198], which is a general family of Short-chain dehydrogenases and reductases. A match to this extension indicates that the protein is probably an alcohol dehydrogenase. This indicates that the sequence of the invention has properties similar to those of other proteins known to contain this/these domain(s) and similar to the properties of these domains.

(R)-3-hydroxybutyrate dehydrogenase (BDH) is a mitochondrial membrane enzyme with an absolute and specific requirement for phosphatidylcholine, which acts as an allosteric activator of BDH enzymatic activity. BDH has served as a prototype for lipid-requiring enzymes. By screening a human heart cDNA library with degenerate oligonucleotides based on peptide sequences from purified bovine BDH, cDNAs encoding BDH (fragment, missing N-terminal) have been isolated. The deduced 343-amino acid protein contains a 46-residue leader peptide, which is cleaved to produce the mature form. Sequence analysis revealed that the first two-thirds of the BDH protein is homologous to short-chain alcohol dehydrogenases (SCADHs), with the homology encompassing the putative coenzyme-binding and active sites of the SCADHs; this region of BDH also has the predicted secondary structure motif of alternating alpha-helices and beta-sheets that is characteristic of SCADHs. The data suggests

that the remainder of the BDH protein contains elements that form the substrate- and lipid-binding sites. Northern blot analysis revealed that BDH is expressed in rabbit heart tissue.

The novel human D-beta-hydroxybutyrate dehydrogenase Protein of the invention has 95% homology to (R)-3-hydroxybutyrate dehydrogenase (BDH) described by Marks et al.

- 5 Therefore it is anticipated that this novel protein has a role in the regulation of essentially all cellular functions and could be a potentially important target for drugs. Such drugs may have important therapeutic applications, such as treating diabetes and obesity diseases. See, Marks, A. R., et al., *J. Biol. Chem.* 267: 15459-15463, 1992.

## NOV15

- 10 NOV15 includes four novel TEN-M3-like proteins disclosed below. The disclosed sequences have been named NOV15a, NOV15b, NOV15c, and NOV15d. Unless specifically addressed as NOV15a, NOV15b, NOV15c, or NOV15d, any reference to NOV15 is assumed to encompass all variants.

### NOV15a

- 15 A disclosed NOV15a nucleic acid of 8675 nucleotides (also referred to as SC145665404\_A or CG55069-01) (SEQ ID NO:35) encoding a novel TEN-M3-like protein is shown in Table 15A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 151-153 and ending with a TAA codon at nucleotides 8326-8328. Putative untranslated regions upstream from the initiation codon and downstream from the
- 20 termination codon are underlined and the start and stop codons are in bold in Table 15A.

**Table 15A. NOV15a nucleotide sequence (SEQ ID NO:35)**

<p>TTTGGCCTCGGGCCAGAATTTCGGCACGAGGGGTCTGGAGCTTGGAGGAGAAGTCTGAACTAAGGATAAAC  TAAAGAGAGGCCAATGAGACTTGAACCTTGAGCCTAAGTTGTCAACAGCAGGACTGATGTGCACACAGAA  GGAATGAAGTATGGATGTGAAAGAACGCAGGCCTTACTGCTCCCTGACCAAGAGCAGACGAGAGAAGGAA  CGGCGCTACACAAATTCCTCCGCAGACAATGAGGAGTGCCGGGTACCCACACAGAAGTCTACAGTTCCA  GCGAGACATTGAAAGCTTTTGATCATGATTCTCGCGGCTGCTTTACGGCAACAGAGTGAAGGATTTGGT  TCACAGAGAAGCAGACGAGTTCACTAGACAAGGACAGAATTTACCTAAGGCAGTTAGGAGTTGTGAA  CCAGCAACTCGAAGAGGACTGGCATTGTTGTGCGGAAATGGGGCTCCCTCACAGAGGTTACTCTATCAGTG  CAGGGTCAGATGCTGATACTGAAAATGAAGCAGTGATGTCCCGAGCATGCCATGAGACTTTGGGGCAG  GGGGGTCAAATCAGGCCGAGCTCCTGCCTGTCAAGTCGGTCCAACCTCAGCCCTCACCCTGACAGATACG  GAGCACGAAAAACAAGTCCGACAGTGAGAATGAGCAACCTGCAAGCAATCAAGGCCAGTCTACCCTGCAGC  CCTTGCCGCTTCCCATAGCAGCACTCTGCACAGCATCATCCATCCATCACTTCTCTCAACAGAACTC  CCTGACCAATAGAAGGAACCAGAGTCCGGCCCCGCGGCTGCTTTGCCGCCGAGCTGCAAACCAACCC  GAGTCCGTCCAGCTGCAGGACAGCTGGGTCTTGGCAGTAATGTACCACTGGAAAGCAGGCATTTCTTAT  TCAAAACAGGAACAGGTACAACGCCACTGTTTCACTGCAACCCAGGATACACAATGGCATCTGGCTC  TGTTTATTCAACCACTACTCGGCCACTACCTAGAAACACCCTATCAAGAAGTGCTTTTAAATTCAAGAAG  TCTTCAAAGTACTGTAGCTGGAATGCACTGCACTGTGTGCCGTAGGGGTCTCGGTGCTCTGGCAATAC  TCCTGTCTTATTTTATAGCAATGCATCTCTTTGGCCTCAACTGGCAGCTACAGCAGACTGAAAATGACAC</p>
---

ATTTGAGAATGGAAAAGTGAATTCTGATACCATGCCAACAAACACTGTGTTCATTACCTTCTGGAGACAAT  
 GGAAAATTAGGTGGATTACGCAAGAAAATAACACCATAGATTCCGGAGAACTTGATATTGGCCGAAGAG  
 CAATTCAGAGATTCTCCCGGATCTTCTGGAGATCACAGCTCTTCATTGATCAGCCACAGTTTCTTAA  
 ATTCAATATCTCTCTCAGAAGGATGCATTGATTGGAGTATATGGCCGGAAGAAGTTACCGCTTCCCAT  
 ACTCAGTCTCCCCCAGTATGACTTCGTGGAGCTCTGGATGGCAGCAGGCTGATTGCCAGAGAGCAGC  
 GGAGCCTGCTTGAGACGGAGAGAGCCGGGCGGCGAGGATCCGTGAGCTTCATGAGGCCGCTTTAT  
 CCAGTACTTGGATTCTGGAATCTGGCATCTGGCTTTTATAATGATGGGAAAAATGCAGAGCAGGTGTCT  
 TTTAATACCATTGTTATAGAGTCTGTGGTGAATGTCCCGAAATTGCCATGGAAATGGAGAATGCGTTT  
 CTGGAACCTTGCCATTGTTTTCCAGGATTTCTGGGTCCGATTGTTCAAGAGCCGCTGTCCAGTGTATG  
 TAGTGGCAACGGGAGTACTCCAAGGGCCGCTGCCTGTGTTTCAGCGGCTGGAAGGGCACCAGTGTGAT  
 GTGCCGACTACCCAGTGTATTGACCCACAGTGTGGGGTCTGTGGGATTGTATCATGGGCTCCTGTGCTT  
 GCAGCTCAGGATACAAAGGAGAAAGTTGTGAAGAAGCTGACTGTATAGACCTGGGTGTTCTAATCATGG  
 TGTGTGTATCCACGGGAATGTCACTGCAGTCCAGGATGGGGAGGTAGCAATTGTGAAATACTGAAGACC  
 ATGTGTCCAGACCAGTGTCTCCGGCCACGGAACGTATCTCAAGAAAGTGGCTCCTGCAGTGTGACCCTA  
 ACTGGACTGGCCAGACTGCTCAAACGAAATATGTTCTGTGGACTGTGGCTCACACGGCGTTTGCATGGG  
 GGGAGCGTGTGCTGTAAGAAGGCTGGACGGGCCAGCTGTAATCAGAGAGCCTGCCACCCCCGCTGT  
 GCGGAGCACGGGACCTGCAAGGATGGCAAGTGTGAATGCAGCCAGGGCTGGAATGGAGAGCACTGCACTA  
 TCGCTCACTATTTGGATAAGATAGTTAAAGACAAGATAGGATATAAAGAGGGTGTCTGTGCTGTGCAA  
 CAGCAATGGAAGATGTACCCTGGACCAAAATGGCGGACATTGTGTGTGCCAGCCTGGATGGAGAGGAGCA  
 GGCTGTGACGTAGCCATGGAGACTCTTGCACAGATAGCAAGGACAATGAAGGGGATGGACTCATTGACT  
 GCATGGATCCCGATTGCTGCCTACAGAGTTCCTGCCAGAATCAGCCCTATTGTCTGGGGACTGCCGGATCC  
 TCAGGACATCATTAGCCAAAGCCTTCAATCGCCTTCTCAGCAAGCTGCCAAATCCTTTTATGATCGAATC  
 AGTTTCTTATAGGATCTGATAGCACCCTGTTATACCTGGAGAAAGTCTTTCAATAAGAGCCTTGCACT  
 CTGTCTCAGAGGCCAAGTACTGACTGCTGATGGAATCCACTTATTGGAGTAAATGTCTCGTTTTTCCA  
 TTACCCAGAATATGGATATACTATTACCGCCAGGACGGAATGTTTGAATGTTGTTGGTGGCAAATGGTGGGGCC  
 TCTCTAATCTTTGGTATTTGAACGATCCCATCTCTCACTCAGTATCATACTGTGTGGATTCCATGGAATG  
 TCTTTTATGTGATGGATAACCTAGTCTGAGAGAAAGAAGAGAATGACATTCCAGCTGTGATCTGAGTGG  
 ATTCGTGAGGCCAAATCCCATCATTGTGTGCATCACCTTTATCCACCTTTTTTCTCCTGAAGAC  
 AGTCCCATCATTCCCGAAACACAGGTACTCCACGAGGAACTACAATTCCAGGAACAGATTTGAAACTCT  
 CCTACTTGAGTTCAGAGCTGCAGGGTATAAGTCAGTTCTCAAGATCACCATGACCCAGTCTATTATTC  
 ATTTAATTTAATGAAGGTTTCATCTTATGGTAGCTGTAGTAGGAAGACTCTTCCAAAAGTGGTTTTCTGCC  
 TCACCAAACCTGGCCTATACTTTTATATGGGATAAAACAGATGCATATAATCAGAAAGTCTATGGTCTAT  
 CTGAAGCTGTTGTGTGCTGAGTGGATATGAGTATGAGTGTGTTGGACCTGACTCTGTGGGAAAAGAGGAC  
 TGCCATTCTGCAGGGCTATGAATTGGATGCGTCCAACATGGGTGGCTGGACATTAGATAAAACATCACGTG  
 CTGGATGTACAGAACCGGTATACTGTACAGGGAAACGGGGAAAACAGTTTCATCTCCAGCAGCCTCCAG  
 TCGTGAGTAGCATCATGGGCAATGGGCGAAGGCGCAGCATTTCCTGCCCCAGTTGCAATGGTCAAGCTGA  
 TGGTAACAAGTTACTGGCCCCAGTGGCGCTAGCTTGTGGGATCGATGGCAGTCTGTACGTAGGCGATTTT  
 AACTACGTGCGGCGGATATTCCCTTCTGGAATGTAACAAGTGTCTTAGAACTAAGAAATAAAGATTTTA  
 GACATAGCAGCAACCCAGCTCATAGATACTACCTTGCAACGGATCCAGTCACGGGAGATCTGTACGTTTC  
 TGACACAAACACCCGCGAGAATTTATCGCCCAAAGTCACTTACGGGGGCAAAGACTTGACTAAAAATGCA  
 GAAGTCGTGCGAGGGACAGGGGAGCAATGCCTTCCGTTTACGAGGCGAGATGTGGGGATGGAGGAAG  
 CCGTGGAAGCCACACTCATGAGTCCCAAGGAATGGCAGTTGATAAGAATGGATTAACTACTTTGTTGA  
 TGGAAACCATGATTAGGAAAGTTGACCAAAATGGAATCATATCAACTCTTCTGGGCTCTAACGATTTGACT  
 TCAGCCAGACCTTTAACTTGTGACACCAGCATGCACATCAGCCAGGTACGTCTGGAATGGCCCACTGACC  
 TAGCCATTAACCTTATGGATAACTCCATTTATGTCTGGATAAATAATGATGTTTTACAGATCACTGAAAA  
 TCGTCAAGTTGCTGCTGCTGAGCGGCCATGCAGTGTGAGTTCCCGGAGTGGAAATATCCTGTGGGG  
 AAGCAGCGGTGCGAGACAACACTGGAATCAGCCACTGCCATTGCTGTGTCTACAGTGGGGTCTGTACA  
 TTACTGAAACTGATGAGAAGAAAATTAACCGGATAAGGCAGGTCAACAACAGATGGAGAAATCTCCTTAGT  
 GGCCGAATACCTTCAGAGTGTGACTGCAAAAATGATGCCAACTGTGACTGTTACCAGAGTGGAGATGGC  
 TACGCCAAGGATGCCAACTCAGTGCCCATCCTCCCTGGCTGCTTCTCCAGATGGTACACTGTATATTG  
 CAGATCTAGGGAATATCCGGATCCGGGCTGTGTCAAAGAATAAGCCTTTACTTAACTCTATGAACCTTCTA  
 TGAAGTTGCGTCTCCAACCTGATCAAGAATCTACATCTTTGACATCAATGGTACTACCAATATACTGTA  
 AGTTTAGTCACTGGTGATTACCTTTACAATTTTAGTACAGCAATGACAATGATATTACTGCTGTGACAG  
 ACAGCAATGGCAACACCCTTAGAATTAGACGGGACCCAAATCGCATGCCAGTTCGAGTGGTGTCTCCTGA  
 TAACCAAGTGATATGGTTGACAATAGGAACAAATGGATGTTTGAAGGCATGACTGCTCAAGGACTGGAA  
 TTAGTTTTGTTTACTTACCATGGCAATAGTGGCTTTTAGCCACTAAAAGTGATGAACTGGATGGACAA  
 CGTTTTTTGACTATGACAGTGAAGGTGCTGTGACAAATGTTACGTTTCCAAGTGGAGTGGTCACAAACCT  
 GCATGGGGACATGGACAAGGCTATCACAGTGGACATTGAGTCATCTAGCCGAGAAGAAGATGTGAGCATC  
 ACTTCAAATCTGTCTCGATCGATTCTTCTACACCATGGTTCAAGATCAGTTAAGAAACAGCTACCAGA  
 TTGGTTATGACGGCTCCCTCAGAATTATCTACGCGAGTGGCTGGACTCACACTACCAACAGAGCCGCA  
 CGTTCTGGCTGGCACCGCTAATCCGACGGTTGCCAAAAGAAACATGACTTTGCCTGGCGAGAACGGTCAA  
 AACTTGGTGAATGGAGATTCCGAAAAGAGCAAGCCCAAGGAAAGTCAATGTCTTTGGCCGAAGCTCA

GGGTTAATGGCAGAAACCTCCTTTTCAGTTGACTTTGATCGAACAACAAAGACAGAAAAGATCTATGACGA  
 CCACCGTAAATTTCTACTGAGGATCGCCTACGACACGTCTGGGCACCCGACTCTCTGGCTGCCAAGCAGC  
 AAGCTGATGGCCGTCAATGTACCTATTATCCACAGGTCAAATTGCCAGCATCCAGCGAGGCACCACTA  
 GCGAGAAAGTAGATTATGACGGACAGGGGAGGATCGTGTCTCGGGTCTTTGCTGATGGTAAAACATGGAG  
 TTACACATATTTAGAAAAGTCCATGGTTCCTTCTGCTTCATAGCCAGCGGCAGTACATCTTGAATACGAT  
 ATGTGGGACCGCTGTCTGCCATCACCATGCCAGTGTGGCTCGCCACACCATGCAGACCATCCGATCCA  
 TTGGCTACTACCGCAACATATACAACCCCCCGGAAAGCAACGCCTCCATCATCAGGACTACAACGAGGA  
 AGGGCTGCTTCTACAAACAGCTTTCTTGGGTACAAGTCGGAGGGTCTTATTCAAATACAGAAGGCAGACT  
 AGGCTCTCAGAAATTTTATATGATAGCACAAAGAGTCAGTTTTACCTATGATGAAACAGCAGGAGTCCTAA  
 AGACAGTAAACCTCCAGAGTGATGGTTTTATTTGCACCATTAGATACAGGCAAATTGGTCCCTGATTGA  
 CAGGCAGATTTTCCGCTTTAGTGAAGATGGGATGGTAAATGCAAGATTTGACTATAGCTATGACAACAGC  
 TTTTCAGTGACCATGCAGGGTGTGATCAATGAAACGCCACTGCCTATTGATCTGTATCAGTTTGATG  
 ACATTTCTGGCAAAGTTGAGCAGTTTGGAAAGTTTGGAGTTATATATTATGATATTAACAGATCATTTTC  
 TACAGCTGTAATGACCTATACGAAGCACTTTGATGCTCATGGCCGTATCAAGGAGATTCAATATGAGATA  
 TTCAGGTCGCTCATGTACTGGATTACAATTCAATGATGATAACATGGGTGGGTAACCAAGAGAGAGATTA  
 AAATAGGGCCCTTTGCCAACACCACCAATATGCTTATGAATATGATGTTGATGGACAGCTCCAAACAGT  
 TTACCTCAATGAAAAGATAATGTGGCGGTACAACCTACGATCTGAATGGAAACCTCCATTTACTGAACCCA  
 AGTAACAGTGCGCGTCTGACACCCCTTCGCTATGACCTGCGAGACAGAATCACTCGACTGGGTGATGTTTC  
 AATATCGGTTGGATGAAGATGGTTTCTACGTCAAAGGGGCACGGAATCTTTGAATATAGCTCCAAGGG  
 GCTTCTAACTCGAGTTTACAGTAAAGGCAGTGGCTGGACAGTGATCTACCGTTATGACGGCCTGGGAAGG  
 CGTGTCTTAGCAAAACCAGTCTAGGACAGCACCTGCAGTTTTTTTTATGCTGACTTAACTTATCCCACTA  
 GGATTACTCATGTCTACAACCATTTCGAGTTTCAGAAATTACCTCCCTGTATTATGATCTCCAAGGACATCT  
 TTTTGCCATGGAAATCAGCAGTGGGGATGAATCTATATTGCATCGGATAACACAGGGACACCACTGGCT  
 GTGTTCACTAGCAATGGGCTTATGCTGAAACAGATTCACTACACTGCATATGGGGAAATCTATTTTGACT  
 CTAATATTGACTTTCACTGGTAATTTGGATTTTCACTGGTGGCTGTATGACCACTCACCAAATTAATCCA  
 CTTTGGAGAAAGAGATTATGACATTTTGGCAGGACGTTGGACAACACCTGACATAGAAATCTGGAAAAGA  
 ATTGGGAAGGACCCAGCTCCTTTTAACTTGTACATGTTTAGGAATAACAACCTGCAAGCAAAATCCATG  
 ACGTGAAAGATTACATCACAGATGTTAACAGCTGGCTGGTGACATTTGGTTTCCATCTGCACAATGCTAT  
 TCCTGGATTCCCTGTTCCCAAATTTGATTTAACAGAACCTTCTTACGAACCTGTGAAGAGTCAGCAGTGG  
 GATGATATACCGCCATCTTCGGAGTCCAGCAGCAAGTGGCGCGGCAGGCCAAGGCCTTCCTGTGCTGG  
 GGAAGATGGCCGAGGTGCAGGTGAGCCGGCGCCGGGCGCGCGCAGTCCTGGCTGTGGTTTCGCCAC  
 GGTCAAGTCGCTGATCGGCAAGGGCGTCATGCTGGCCGTACGCCAGGGCCGCGTGCAGACCAACGTGCTC  
 AACATCGCCAACGAGGACTGCATCAAGGTGGCGGCCGTGCTCAACAACGCCTTCTACCTGGAGAACCTGC  
 ACTTCACCATCGAGGGCAAGGACACGCACTACTTCATCAAGACCACGCCCCGAGAGCGACCTGGGCAC  
 GCTGCGGTTGACCAGCGGCCGCAAGGCGCTGGAGAACGGCATCAACGTGACGGTGTGCGAGTCCACCACG  
 GTGGTGAACGGCAGGACGCGCAGGTTTCGCGACGTGGAGATGCAGTTTCGGCGCGCTGGCGCTGCACGTGC  
 GCTACGGCATGACCTGGACGAGGAGAAGGCGCGCATCCTGGAGCAGGCGCGGACGCGCGCTCGCCCG  
 GGCCTGGGCGCGGAGCAGCAGCGCTGCGCGACGGCGAGGAGGCGCGCGCTCTGGACGGAGGGCGAG  
 AAGCGGCAGCTGCTGAGCGCCGGCAAGGTGCAGGGCTACGACGGGTACTACGTACTCTCGGTGGAGCAGT  
 ACCCCGAGCTGGCCGACAGCGCCAACAACATCCAGTTCTTGCGGCAGAGCGAGATCGGCAGGAGGTAAACG  
 CCCGGGCCGCGCCCGGAGCCGCTCACGCCCTGCCACATGTCTCTGTGGCACAAACCGAGTGGGACTC  
 TCCAACGCCCAAGAGCCTTCTCCCGGGGAATGAGACTGCTGTTACGACCCACACCCACACCGCGAAAA  
 CAAGGACCGCTTTTTCGGAATGACCTTAAAGGTGATCGGCTTTAACGAATATGTTTACATATGCATAGC  
 GCTGCACTCAGTCGAGTGAACGTAGCCAGAGGAAAAAAATCATCAAGGACAAAGGCCTCGACCTGTT  
 GCGCTGGGCGCTCTGTTCTTCTAGGCACTGTATTTAACTAACTTTAAAAAAG

The TEN-M3 NOV15a disclosed in this invention maps to chromosome 4.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 5307 of 5309 bases (99%) identical to a gb:GENBANK-  
 ID:AB040888|acc:AB040888.1 mRNA from Homo sapiens (Homo sapiens mRNA for  
 5 KIAA1455 protein, partial cds).

A disclosed NOV15a polypeptide (SEQ ID NO:36) encoded by SEQ ID NO:35 has 2725 amino acid residues and is presented in Table 15B using the one-letter code. NOV15a

seems to be a Type II (Ncyt Cexo) membrane protein with an INTEGRAL Likelihood of -9.39 for Transmembrane 309 - 325 (305 - 337). The SignalP, Psort and/or Hydropathy results predict that NOV15a has no signal peptide and is likely to be localized in the nucleus with a certainty of 0.8000. In an alternative embodiment, NOV15a is likely to be localized to the plasma membrane with a certainty of 0.7900, or to the microbody (peroxisome) with a certainty of 0.3424, or to the Golgi body with a certainty of 0.3000.

**Table 15B. NOV15a protein sequence (SEQ ID NO:36)**

```
MDVKERRPYCSLTKSRREKERRYTNSSADNEECRVPTQKSYSSSETLKAFDHDSRLLYGNRVKDLVHRE
ADEFTRQGNFTLRQLGVCEPATRRGLAFCAEMGLPHRGYSISAGSDADTENEAVMSPEHAMRLWGRGVK
SGRSSCLSSRSNSALTTLDTEHENKSDSENEQPASNQGGSTLQPLPPSHKQHSQAHHPSITSLNRNSLTN
RRNQSPAPPAALPAELQTTPEVQLQDSWVLGSNVPLESRHFLFKTGTGTPLFSTATPGYTMASGSVYS
PPTRPLPRNTLSRSAFKFKKSSKYCSWKCTALCAVGVSVLLAILLSYFIAMHLFGLNWQLQQTENDTFEN
GKVNSDTMTNTVSLPSGDNGKLGFTQENNTIDSGELDIGRRAIQEI PPGIFWRSQLFIDQPQFLKFNI
SLQKDALIGVYGRKKLPPSHTQSSPQYDFVELLDGSRLLIAREQRSLLETERAGRQARSVSLHEAGFIQYL
DSGIWHLAFYNDGKNAEQVSFNTIVIESVVECPRNCHNGECCVSGTCHCFPGFLGPDCSRACPVLCSGN
GQYSKGRCLCFSGWKTECDVPTTQCIDPQCGRGICIMGSCACSSGYKGESCEEADCIDPGCSNHGVC
HGECHSPGWGGSNCEILKTMCPDQCSGHGTYLQESGSCDNDNWTGPDSCNEICSVDCSGHGVCMGGTC
RCEEGWTGPACNQRAHPCAEHGTCKDGKCECSQGWNGEHCTIAHYLDKIVKDKIGYKEGCPGLCNSNG
RCTLDQNGGHCVCQPGWRGAGCDVAMETLCTDSKDNEDGLIDCMDPDCCLOSSCQNPYCRGLPDPQDI
ISQSLQSPSQQAASFYDRISFLIGSDSTHVIPGESPFNKSLASVIRGQVLTADGTPLIGNVVSFFHYPE
YGYTTITRQDGMFDLVANGGASLTIVFERSPFLLTQYHTVWIPWNVFYVMDTLVMEKEENDIPSCDLSGFVR
PNPIIVSSPLSTFFRSPEDSPIIPETQVLHEETTIPGTDLKLSSRAAGYKSVLKITMTQSIIPFNL
MKVHLMVAVVGRFLQKWFAPSNLAYTFIWDKTDAYNQKVYGLSEAVSVGYEYESCLDLTLWEKRTAIL
QGYELDASNMGWTLDKHHVLDVQNGILYKNGENQFISQPPVVSSIMGNRRRSISCPSCNGQADGNK
LLAPVALACGIDGSLYVGFNYVRRIFPSGNVTSVLELRNKDFRHSSNPAHRYLATDPVTGDLVSDTN
TRRIYRPKSLTGAKDLTKNAEVVAGTGEQCLPFDEARCGDGGKAVEATLMSPKGMAVDKNGLIYFVDGTM
IRKVDQNGIISTLLGSNDLTSARPLTCDTSMHISQVRLEWPTDLAINPMDNSIYVLDNNVVLQITENRQV
RIAAGRPMHCQVPGVEYPVGKHAVQTTLESATAIAVSYSGLVYITETDEKKINRIRQVTTDGEISLVAGI
PSECDCKNDANCDYQSGDGYAKDAKLSAPSSLAASPDGTLIADLGNIRIRAVSKNKPLLSNMNFYEVA
SPTDQELYIFDINGTHQYTVSLVTGDYLYNFSYSNDNDITAVTDSNGNTLRIRRDENRMPVRVSPDNQV
IWLITIGTNGCLKGMTAQGLELVLFTHGNSGLLATKSDETGWTTFFDYDSEGRLTNVTFPTGVVTLNHGD
MDKAITVDIESSSREEDVSITSNLSSIDSFYTMVQDQLRNSYQIGYDGLRIIYASGLDSHYQTEPHVLA
GTANPTVAKRNMTLPGENGQNLVEWRFRKEQAQGVNVFGRKLRVNGRNLLSVDFTRTTKTEKIYDHRK
FLLRIAYDTSGHPTLWLPSSKLMVNVYTSSTGQIASIQRGTTSEKVDYDQGRIVSRVFADGKTWSYTY
LEKSMVLLLSQRQYIFEYDMWDRLSAITMPSVARHTMQTIRSIGYYRNIYNPPESNASIITDYNEEGLL
LQTAFLGTSRRVLFKYRRQTRLSEILYDSTRVSFTYDETAGVLKTVNLQSDGFICTIRYRQIGPLIDRQI
FRFSEDGMVNARFDYSYDNSFRVTSMQGVINETPLPIDLYQFDDISGKVEQFGKFGVIYYDINQIISTAV
MTYTKHFDAHGRIKEIQYEIFRSLMYWITIYDNMGRVTKREIKIGPFANTTKYAYEYDVGQLQTVYLN
EKIMWRYNYDLNGLNHLNPSNSARLTPLRYDLRDRITRLGDVQYRLDEDGFLRQRGTEIFEYSSKGLLT
RVYSKSGSWTVIYRYDGLGRRVSSKTSLGQHLQFFYADLTYPTRITHVYNHSSSEITSLIYDQLQHLFAM
EISSGDEFYIASDNTGTPLAVFSSNGLMLKQIQYTAYGEIYFDSNIDFQLVIGFHGGLYDPLTKLIHFGE
RDYDILAGRWTTPDIEIWKRIKDPAPFNLYMFRNNNPASKIHDVKDYITDVNSWLVTFGFHLHNAIPGF
PVPKFDLTPEPSYELVKSQQWDDIPPIFGVQQQVARQAKAFLSLGKMAEVQVSRRRAGGAQSWLWFATVKS
LIGKGVMLAVSQGRVQTNVLNIANEDCIKVAAVLNNAFYLENLHFTIEGKDTHYFIKTTTPESDLGTLRL
TSGRKALENGINVTVSQSTTVVNGRTRRFADVEMQFGALALHVRYGMTLDEEKARILEQARQALARAWA
REQQVRVDGEEGARLWTEGEKQRLLSAGKVQGYDGYVLSVEQYPELADSANNIQFLRQSEIGRR
```

The full amino acid sequence of the protein of the invention was found to have 2663 of 2725 amino acid residues (97%) identical to, and 2696 of 2725 amino acid residues (98%) similar to, the 2715 amino acid residue ptrn:SPTREMBL-ACC:Q9WTS6 protein from Mus musculus (Mouse) (TEN-M3).

The TEN-M3 disclosed in this invention is expressed in at least the following tissues: Brain, Cerebellum, Colon, Coronary Artery, Dermis, Heart, Hippocampus, Kidney, Lung, Lymph node, Mammary gland/Breast, Ovary, Parathyroid Gland, Pineal Gland, Placenta, Prostate, Smooth Muscle, Testis, Uterus. This information was derived by determining the tissue sources of the sequences that were included in the invention including but not limited to SeqCalling sources, Public EST sources, Literature sources, and/or RACE sources. Taqman expression analysis reveals that The TEN-M3 disclosed in this invention is expressed by several brain regions and by brain and lung tumor derived cell lines in TaqMan panel 1 and by kidney and lung tumors in panel 2.

The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from cancer preferably in kidney and lung tumors. The Potential Role(s) of TEN-M3-like protein and nucleic acid disclosed herein in Tumorigenesis is likely to be related to cell migration and invasion conferring higher metastatic potential. Therapeutic targeting of TEN-M3-like protein and nucleic acid disclosed herein with a monoclonal antibody is anticipated to limit or block the extent of tumor cell migration and invasion and tumor metastasis, preferably in melanomas tumors.

#### NOV15b

A disclosed NOV15b nucleic acid of 8645 nucleotides (also referred to as CG55069-02) (SEQ ID NO:37) encoding a novel TEN-M3-like protein is shown in Table 15C. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 151-153 and ending with a TAA codon at nucleotides 8314-8316. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined and the start and stop codons are in bold in Table 15C.

**Table 15C. NOV15b nucleotide sequence (SEQ ID NO:37)**

<p>TTTGGCCTCGGGCCAGAATTCGGCACGAGGGGTCTGGAGCTTGGAGGAGAAGTCTGAAC  AAGGATAAACTAAAGAGAGGCCAATGAGACTTGAACCCTGAGCCTAAGTTGTCACCAGCA  GGACTGATGTGCACACAGAAGGAATGAAGTATGGATGTGAAAGAACGCAGGCCTTACTGC  TCCCTGACCAAGAGCAGACGAGAGAAGGAACGGCGCTACACAAATTCCTCCGCAGACAAT  GAGGAGTGCCGGGTACCCACACAGAAGTCCTACAGTTCCAGCGAGACATTGAAAGCTTTT  GATCATGATTCTCGCGGCTGCTTTACGGCAACAGAGTGAAGGATTTGGTTCACAGAGAA  GCAGACGAGTTCACTAGACAAGGACAGAATTTTACCCTAAGGCAGTTAGGAGTTTGTGAA  CCAGCAACTCGAAGAGGACTGGCATTTTGTGCGGAAATGGGGCTCCCTCACAGAGGTTAC  TCTATCAGTGCAGGGTCAGATGCTGATACTGAAAATGAAGCAGTGATGTCCCCAGAGCAT  GCCATGAGACTTTGGGGCAGGGGGTCAAATCAGGCCGCAGCTCCTGCCTGTCAAGTCGG</p>
--

TCCAACTCAGCCCTCACCTGACAGATACGGAGCACGAAAACAAGTCCGACAGTGAGAAT  
GAGCAACCTGCAAGCAATCAAGGCCAGTCTACCCTGCAGCCCTTGCCGCTTCCCATAAG  
CAGCACTCTGCACAGCATCATCCATCCATCACTTCTCTCAACAGAACTCCCTGACCAAT  
AGAAGGAACCAGAGTCCGGCCCCGCGGCTGCTTTGCCGCGGAGCTGCAAACCACACCC  
GAGTCCGTCCAGCTGCAGGACAGCTGGGTCTTGGCAGTAATGTACCACTGGAAGCAGG  
CATTTCTATTCAAAACAGGAACAGGTACAACGCCACTGTTCACTACTGCAACCCAGGA  
TACACAATGGCATCTGGCTCTGTTTATTACCACCTACTCGGCCACTACCTAGAAACACC  
CTATCAAGAAGTGCTTTTAAATTCAAGAAGTCTTCAAAGTACTGTAGCTGGAAATGCACT  
GCACTGTGTGCCGTAGGGGTCTCGGTGCTCCTGGCAATACTCCTGTCTTATTTTATAGCA  
ATGCATCTCTTTGGCCTCAACTGGCAGCTACAGCAGACTGAAAATGACACATTTGAGAAT  
GGAAAAGTGAATTCTGATACCATGCCAACAAACTGTGTCTTACCTTCTGGAGACAAT  
GGAAAATTAGGTGGATTTACGCAAGAAAATAACACCATAGATTCCGGAGAACTTGATATT  
GGCCGAAGAGCAATTCAAGAGATTCTCCCGGGATCTTCTGGAGATCACAGCTCTTCATT  
GATCAGCCACAGTTTCTTAAATTCAATATCTCTCTCAGAAGGATGCATTGATTGGAGTA  
TATGGCCGAAAGGCTTACCGCCTTCCCATACTCAGTATGACTTCGTGGAGCTCCTGGAT  
GGCAGCAGGCTGATTGCCAGAGAGCAGCGGAGCCTGCTTGAGACGGAGAGAGCCGGGCGG  
CAGGCGAGATCCGTGAGCCTTCATGAGGCCGGCTTTATCCAGTACTTGGATTCTGGAATC  
TGGCATCTGGCTTTTTATAATGATGGGAAAATGCAGAGCAGGTGTCTTTAATACCATT  
GTTATAGAGTCTGTGGTGGAAATGTCCCCGAAATTGCCATGGAAATGGAGAATGCGTTTCT  
GGAATTGCAATTGTTTTCCAGGATTTCTGGGTCCGATTGTTCAAGAGCCGCTGTCCA  
GTGTTATGTAGTGGCAACGGGCAGTACTCCAAGGGCCGCTGCCTGTGTTTCAGCGGCTGG  
AAGGGCACCGAGTGTGATGTGCCGACTACCCAGTGTATTGACCCACAGTGTGGGGGTCTG  
GGGATTTGTATCATGGGCTCCTGTGCTTGCAGCTCAGGATACAAAGGAGAAAAGTTGTGAA  
GAAGCTGACTGTATAGACCTGGGTGTTCTAATCATGGTGTGTATCCACGGGGAATGT  
CACTGCAGTCCAGGATGGGAGGTAGCAATTGTGAAATACTGAAGACCATGTGTCCAGAC  
CAGTGCTCCGGCCACGGAACGTATCTTCAAGAAAGTGGCTCCTGCAGTGTGACCCTAAC  
TGGACTGGCCAGACTGCTCAAACGAAATATGTTCTGTGGACTGTGGCTCACACGGCGTT  
TGCATGGGGGGGACGTGTGCTGTGAAGAAGGCTGGACGGGCCCCAGCCTGTAATCAGAGA  
GCCTGCCACCCCGCTGTGCCGAGCACGGGACCTGCAAGGATGGCAAGTGTGAATGCAGC  
CAGGGCTGGAATGGAGAGCACTGCACTATCGCTCACTATTTGGATAAGATAGTTAAAGAC  
AAGATAGGATATAAAGAGGGTTGTCTGGTCTGTGCAACAGCAATGGAAGATGTACCCTG  
GACCAAAATGGCGGACATTGTGTGTGCCAGCCTGGATGGAGAGGAGCAGGCTGTGACGTA  
GCCATGGAGACTCTTTCACAGATAGCAAGGACAATGAAGGGGATGGACTCATTTGACTGC  
ATGGATCCCGATTGCTGCCTACAGAGTTCTGCGGAGAATCAGCCCTATTGTGCGGGACTG  
CCGGATCCTCAGGACATCATTAGCCAAAGCCTTCAATCGCCTTCTCAGCAAGCTGCCAAA  
TCCTTTTATGATCGAATCAGTTTCTTATAGGATCTGATAGCAACCATGTTATACCTGGA  
GAAAGTCTTTCAATAAGAGCCTTGCACTGTGTATCAGAGGCCAAGTACTGACTGCTGAT  
GGAATCCACTTATTGGAGTAAATGTCTCGTTTTTCCATTACCCAGAATATGGATATACT  
ATTACCCGCCAGGACGGAATGTTTGACTTGGTGGCAAATGGTGGGGCCTCTCTAACTTTG  
GTATTTGAACGATCCCCATTCTCACTCAGTATCATACTGTGTGGATTCCATGGAATGTC  
TTTTATGTGATGGATAACCTAGTCATGGAGAAAGAAGAGAATGACATTCAGCTGTGAT  
CTGAGTGGATTCTGTGAGGCCAAATCCCATCATTGTGTGTATCACCTTTATCCACCTTTTTC  
AGATCTTCTCCTGAAGACAGTCCCATCATTCCCGAAACACAGGTAATCCACGAGGAACT  
ACAATTCAGGAACAGATTTGAACTCTCCTACTTGAGTTCCAGAGCTGCAGGGTATAAG  
TCAGTTCTCAAGATCACCATGACCCAGTCTATTATTCCATTAAATTAATGAAGGTTTAT  
CTTATGGTAGCTGTAGTAGGAAGACTCTTCCAAAAGTGGTTTCTGCCTCACCAAACCTTG  
GCCTATACTTTTATATGGGATAAAACAGATGCATATAATCAGAAAAGTCTATGGTCTATCT  
GAAGCTGTTGTGTGAGTTGGATATGAGTATGAGTCGTGTTTGGACCTGACTCTGTGGGAA  
AAGAGGACTGCCATTCTGCAGGGCTATGAATTGGATGCGTCCAACATGGGTGGCTGGACA  
TTAGATAAACATCACGTGCTGGATGTACAGAACGGTATATACTGTACAAGGGAACGGGGAA  
AACCAGTTTATCTCCAGCAGCCTCCAGTCTGAGTAGCATCATGGGCAATGGGCGAAGG  
CGCAGCATTTCTGCCCCAGTTGCAATGGTCAAGCTGATGGTAACAAGTTACTGGCCCCA  
GTGGCGCTAGCTTGTGGGATCGATGGCAGTCTGTACGTAGGCGATTTCAACTACGTGCGG  
CGGATATTCCCTTCTGGAAATGTAACAAGTGTCTTAGAACTAAGAAATAAGATTTTAGA  
CATAGCAGCAACCCAGCTCATAGATACTACCTTGCAACGGATCCAGTCACGGGAGATCTG  
TACGTTTCTGACACAAACACCCGAGAAATTTATCGCCCAAAGTCACTTACGGGGGCAAAA  
GACTTGACTAAAAATGCAGAAGTCGTGCGAGGGACAGGGGAGCAATGCCTTCCGTTTGAC  
GAGGCGAGATGTGGGGATGGAGGGAAGGCCGTGGAAGCCACACTCATGAGTCCCAAAGGA  
ATGGCAGTTGATAAGAATGGATTAATCTACTTGTGTGATGGAACCATGATTAGGAAAGTT  
GACCAAAATGGAATCATATCAACTCTTCTGGGCTCTAACGATTTGACTTCAGCCAGACCT  
TTAAGTTGTGACACCCAGCATGCACATCAGCCAGGTACGTCTGGAATGGCCCACTGACCTA  
GCCATTAACCTATGGATAACTCCATTTATGTCCTGGATAATAATGTAGTTTTACAGATC

ACTGAAAATCGTCAAGTTCGCATTGCTGCTGGACGGCCCATGCACTGTCAGGTTCCCGGA  
 GTGGAATATCCTGTGGGAAGCACGCGGTGCAGACAACACTGGAATCAGCCACTGCCATT  
 GCTGTGTCTACAGTGGGGTCTGTACATTACTGAAACTGATGAGAAGAAAATTAACCGG  
 ATAAGGCAGGTCAACACAGATGGAGAAATCTCCTTAGTGGCCGGAATACCTTCAGAGTGT  
 GACTGCAAAAATGATGCCAACTGTGACTGTTACCAGAGTGGAGATGGCTACGCCAAGGAT  
 GCCAACTCAGTGGCCCATCTCCTGGCTGCTTCCAGATGGTACACTGTATATTGCA  
 GATCTAGGGAATATCCGGATCCGGGCTGTGTCAAAGAATAAGCCTTTACTTAACTCTATG  
 AACTTCTATGAAGTTGCGTCTCCAACATGATCAAGAACTCTACATCTTTGACATCAATGGT  
 ACTACCAATATACTGTAAGTTTAGTCACTGGTGATTACCTTTACAATTTTAGCTACAGC  
 AATGACAATGATATTACTGTGTGACAGACAGCAATGGCAACACCCTTAGAATTAGACGG  
 GACCCAAATCGCATGCCAGTTCGAGTGGTGTCTCTGATAACCAAGTGATATGGTTGACA  
 ATAGGAACAAATGGATGTTTTGAAAGGCATGACTGCTCAAGGACTGGAATTAGTTTTGTTT  
 ACTTACCATGGCAATAGTGGCCTTTTAGCCACTAAAAGTGATGAACTGGATGGACAACG  
 TTTTTGACTATGACAGTGAAGGTCGTCTGACAAATGTTACGTTTTCCAACCTGGAGTGGT  
 ACAAACCTGCATGGGGACATGGACAAGGCTATCACAGTGGACATTGAGTCATCTAGCCGA  
 GAAGAAGATGTCAGCATCACTTCAAATCTGTCTCGATCGATTCTTTCTACACCATGGTT  
 CAAGATCAGTTAAGAAACAGCTACCAGATTGGTTATGACGGCTCCCTCAGAATTATCTAC  
 GCCAGTGGCCTGGACTCACACTACCAACAGAGCCGCACGTTCTGGCTGGCACCGCTAAT  
 CCGACGGTTGCCAAAAGAAACATGACTTTGCTGGCGAGAACGGTCAAACTTGGTGGAA  
 TGGAGATTCCGAAAAGAGCAAGCCCAAGGGAAAGTCAATGTCTTTGGCCGCAAGCTCAGG  
 GTTAATGGCAGAAACCTCCTTTCACTTTGACTTTGATCGAACAACAAAGACAGAAAAGATC  
 TATGACGACCACCGTAAATTTCTACTGAGGATCGCCTACGACACGTCTGGGCACCCGACT  
 CTCTGGCTGCCAAGCAGCAAGCTGATGGCCGTCAATGTCACCTATTATCCACAGGTCAA  
 ATTGCCAGCATCCAGCGAGGCACCACTAGCGAGAAAGTAGATTATGACGGACAGGGGAGG  
 ATCGTGTCTCGGGTCTTTGCTGATGGTAAACATGGAGTTACACATATTTAGAAAAGTCC  
 ATGGTTCTTCTGCTTCATAGCCAGCGGCAGTACATCTTGAATACGATATGTGGGACCGC  
 CTGTCTGCCATCACCATGCCAGTGTGGCTCGCCACACCATGCAGACCATCCGATCCATT  
 GGCTACTACCGCAACATATACAACCCCCGGAAGCAACGCCTCCATCATCACGGACTAC  
 AACGAGGAAGGGCTGCTTCTACAAACAGCTTTCTTGGGTACAAGTCGGAGGGTCTTATTC  
 AAATACAGAAGGCAGACTAGGCTCTCAGAAATTTTATATGATAGCACAAAGAGTCAGTTTT  
 ACCTATGATGAAACAGCAGGAGTCTTAAAGACAGTAAACCTCCAGAGTGTGGTTTTATT  
 TGCACCATTAGATACAGGCAAATTTGGTCCCCTGATTGACAGGCAGATTTTCCGCTTAGT  
 GAAGATGGGATGGTAAATGCAAGATTTGACTATAGCTATGACAACAGCTTTTCGAGTGACC  
 AGCATGCAGGGTGTGATCAATGAAACGCCACTGCCTATTGATCTGTATCAGTTTGATGAC  
 ATTTCTGGCAAAGTTGAGCAGTTTGGAAAGTTTGGAGTTATATATTATGATATTAACCAG  
 ATCATTTCTACAGCTGTAATGACCTATACGAAGCACTTTGATGCTCATGGCCGTATCAAG  
 GAGATTCAATATGAGATATTGAGTCTGCTCATGTACTGGATTACAATTCAGTATGATAAC  
 ATGGGTGCGGTAACCAAGAGAGAGATTAATAAGGGCCCTTTGCCAACACCACCAATAT  
 GCTTATGAATATGATGTTGATGGACAGCTCCAAACAGTTTACCTCAATGAAAAGATAATG  
 TGGCGGTACAACCTACGATCTGAATGGAAACCTCCATTTACTGAACCAAGTAACAGTGCG  
 CGTCTGACACCCCTTCGCTATGACCTGCGAGACAGAATCACTCGACTGGGTGATGTTCAA  
 TATCGGTGTGGATGAAGATGGTTTCTACGTCAAAGGGGCACGGAAATCTTTGAATATAGC  
 TCCAAGGGGCTTCTAACTCGAGTTTACAGTAAAGGCAGTGGCTGGACAGTGTCTACCGT  
 TATGACGGCCTGGGAAGGCGTGTCTTAGCAAAACAGTCTAGGACAGCACCTGCAGTTT  
 TTTTATGCTGACTTAACTTATCCCACTAGGATTACTCATGTCTACAACCATTGAGTTCA  
 GAAATTACCTCCCTGTATTATGATCTCCAAGGACATCTTTTTGCCATGGAAATCAGCAGT  
 GGGGATGAATTTATATGTCATCGGATAACACAGGGACACCCTGGCTGTGTTTCAGTAGC  
 AATGGGCTTATGCTGAAACAGATTGAGTACACTGCATATGGGGAAATCTATTTTGACTCT  
 AATATTGACTTTCAACTGGTAATTGGATTTTATGGTGGCCTGTATGACCCACTCACCAA  
 TTAATCCACTTTGGAGAAAGAGATTATGACATTTTGGCAGGACGGTGGACAACACCTGAC  
 ATAGAAATCTGGAAGAAATTTGGGAAGGACCCAGCTCCTTTTAACTTGTACATGTTTAGG  
 AATAACAACCCCTGCAAGCAAAATCCATGACGTGAAAGATTACATCACAGATGTTAACAGC  
 TGGCTGGTGACATTTGGTTTCCATCTGCACAATGCTATTCTGGATTCCCTGTTCCCAA  
 TTTGATTTAACAGAACCTTCTTACGAACCTTGTGAAGAGTCAGCAGTGGGATGATATACCG  
 CCCATCTTCGGAGTCCAGCAGCAAGTGGCGCGGCAGGCCAAGGCCTTCCTGTGCTGGGG  
 AAGATGGCCGAGGTGCAGGTGAGCCGGCGCGGGCCGGCGCGCAGTCTGGCTGTGG  
 TTCGCCACGGTCAAGTCGTGATCGGCAAGGGCGTCACTGGCCGTGAGCCAGGGCCGC  
 GTGCAGACCAACGTGCTCAACATCGCCAACGAGGACTGCATCAAGGTGGCGGCCGTGCTC  
 AACACGCCTTCTACCTGGAGAACCTGCACCTCACCATCGAGGGCAAGGACACGCACTAC  
 TTCATCAAGACCAACCGCCGAGAGCGACCTGGGCACGCTGCGGTTGACCAGCGGCCGC  
 AAGGCCCTGGAGAACGGCATCAACGTGACGGTGTGCGAGTCCACCACGGTGGTGAACGGC  
 AGGACGCGCAGGTTCCGGGACGTGGAGATGCAGTTCGGCGCGCTGGCGCTGCACGTGCGC



TACGGCATGACCCTGGACGAGGAGAAGGCGCGCATCCTGGAGCAGGCGCGCAGCGCGCG  
 CTCGCCCCGGGCTGGGCGCGGAGCAGCAGCGCGTGCAGCAGGCGAGGAGGGCGCGCGC  
 CTCTGGACGGAGGGCGAGAAAGCGGCGAGTGTGAGCGCCGGCAAGGTGCAGGGCTACGAC  
 GGGTACTACGTACTCTCGGTGGAGCAGTACCCCGAGCTGGCCGACAGCGCCAACAACATC  
 CAGTTCTGCGGCAGAGCGAGATCGGCAGGAGGTAACGCCCCGGGCGCGCCCGCGAGCC  
 GCTCACGCCCTGCCCCACATTGTCTGTGGCACAACCCGAGTGGGACTCTCCAACGCCCAA  
 GAGCCTTCTCTCCCGGGGAATGAGACTGCTGTTACGACCCACACCCACACCGCGAAAACA  
 AGGACCGCTTTTTTCCGAATGACCTTAAAGGTGATCGGCTTTAACGAATATGTTTACATA  
 TGCATAGCGCTGCACTCAGTCGGACTGAACGTAGCCAGAGGAAAAAAATCATCAAGGA  
 CAAAGGCCCTCGACCTGTTGCGCTGGGCGCTCTGTTCTTCTAGGCACTGTATTTAACTAA  
 CTTTA

The TEN-M3 NOV15b disclosed in this invention maps to chromosome 4.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 5395 of 6175 bases (87%) identical to a gb:GENBANK-

5 ID:AB025412|acc:AB025412.1 mRNA from Mus musculus (Mus musculus mRNA for Ten-m3, complete cds).

A disclosed NOV15b polypeptide (SEQ ID NO:38) encoded by SEQ ID NO:37 has 2721 amino acid residues and is presented in Table 15D using the one-letter code. Although PSORT suggests that the TEN-M3-like protein may be localized nucleus, the protein of  
 10 CuraGen Acc. No. CG55069-02 predicted here is similar to the tenascins family, some members of which are secreted or membrane protein. Therefore it is likely that this novel TEN-M3-like protein also shows similar localization. The hydropathy plot supports this conclusion. NOV15b seems to be a Type II (Ncyt Cexo) membrane protein with an  
 15 INTEGRAL Likelihood of -9.39 for Transmembrane 309 - 325 (305 - 337). The SignalP, Psort and/or Hydropathy results predict that NOV15b has no signal peptide and is likely to be localized in the nucleus with a certainty of 0.8000. In an alternative embodiment, NOV15b is likely to be localized to the plasma membrane with a certainty of 0.7900, or to the microbody (peroxisome) with a certainty of 0.3453, or to the Golgi body with a certainty of 0.3000.

**Table 15D. NOV15b protein sequence (SEQ ID NO:38)**

MDVKERRPYCSLTKSRREKERRYTNSSADNEECRVPTQKSYSSSETLKAFDHDSSRLLYG  
 NRVDLVHREADEFTTRQGQNFTRLQLGVCEPATRRGLAFCAEMGLPHRGYSISAGSDADT  
 ENEAVMSPEHAMRLWGRGVKSGRSSCLSSRSNSALTLDTEHENKSDSENEQPASNQGS  
 TLQPLPPSHKQHSQAHHPSITSLNRNSLTNRNQSPAPPAALPAELQTPESVQLQDSWV  
 LGSNVPLESRHFLFKTGTGTTPLFSTATPGYTMASGSVYSPPTRPLPRNTLSRSAFKFK  
 SSKYCSWKCTALCAVGVSLLAILLSYFIAMHLFGLNWQLQQTENDTFENGKVNSDTMTPT  
 NTVSLPSGDNGKLGFTQENNTIDSGELDIGRRAIQEIPPGIFWRSQFLIDQPQFLKFNI  
 SLQKDALIGVYGRKGLPPSHQYDFVELLDGSRLIAREBQRSLLETERAGRQARSVSLHEA  
 GFIQYLDSGIWHLAFYNDGKNAEQVSFNTIVIESVVECPRNCHGNGECVSGTCHCFPGFL  
 GPDCSRAACPVLCSGNGQYSKGRCLCFSGWKGTECDVPTTQCIDPQCGGRGICIMGSCAC  
 SSGYKGESCEEADCIDPGCSNHGVCIHGECHCSPGWGGSNCEILKTMCPDQCSGHGTYLQ  
 ESGSCTCDPNWTPDCSNEICSVDCSGSHGVCMMGTCCRCEGWTGPACNQRACHPRCAEHG  
 TCKDGKCECSQGWNGEHCIAHYLDKIVKDKIGYKEGCPGLCNSNGRCTLQDQNGGHCVCQ  
 PGWRGAGCDVAMETLCTDSKDNEGDGLIDCMDPCCLQSSCQNQPYCRGLPDPQDIISQS

LQSPSQAAKSFYDRISFLIGSDSTHVIPGESPFNKSLASVIRGQVLTADGTPLIGVNV  
 FFHYPEYGYTITRQDGMFDLVANGGASLTLVFERSPFLLTOYHTVWIPWNVFYVMDTLVME  
 KEENDIPSCDLSGFVRPNPIIVSSPLSTFFRSSPEDSPIIPETQVLHEETTIPGTDLKLS  
 YLSSRAAGYKSVLKITMTQSIIPFNLKVMHLMVAVVGRLFQKWFASPNNLAYTFIWDKTD  
 AYNQKVYGLSEAVVSVGYEYESCLDLTLWEKRTAILQGYELDASNMGGWTLDKHHVLDVQ  
 NGILYKNGENQFISQPPVVSIMGNRRRSISCPSCNGQADGNKLLAPVALACGIDGS  
 LYVGDFNYVRRIFPSGNVTSVLELRNKDFRHSSNPAHRYLATDPVTGDLYVSDTNTRRI  
 YRPKSLTGAKDLTKNAEVVAGTGEQCLPFDEARCGDGGKAVEATLMSPKGMVADKNGLIY  
 FVDGTMIRKVDQNGIISTLLGSNDLTSARPLTCDTSMHISQVRLEWPTDLAINPMDNSIY  
 VLDNNVVLQITENQVRIAAGRPMHCQVPGVEYPVGKHAVQTTLESATAIAVSYSYSGVLYI  
 TETDEKKINRIRQVTTDGEISLVAGIPSECDCKNDANCDYQSGDGYAKDAKLSAPSSLA  
 ASPDGTLYIADLGNIRIRAVSKNPKLLNSMNFYEASPTDQELYIFDINGTHQYTVSLVT  
 GDYLYNFSYSNDNDITAVTDSNGNTLRIRRDPNRMPVRVSPDNQVIWLTIGTNGCLKGM  
 TAQGLELVLFYTHGNSGLLATKSDEGTWTTFFDYDSEGRLTNVTFTPTGVVTLHGDMDKA  
 ITVDIESSSREEDVSITSNLSSIDSFYTMVQDQLRNSYQIGYDGSRLRIYASGLDSHYQT  
 EPHVLGANTPTVAKRNMTPGENGQNLVEWRFRKEQAQGVNVFGRKLRVNGRNLLSVD  
 FDRITTKTEKIYDDHRKFLRLRIAYDTSGHPTLWLPSSKLMVNVYSSSTGQIASIQRGTT  
 EKVDYDQGGRIVSRVFADGKTWSYTYLEKSMVLLLHSQRQYIFEYDMWDRLSAITMPSVA  
 RHTMQTIRSIGYRNINPPESNASIITDYNEEGLLLQTAFLGTSRRVLFKYRRQTRLSE  
 ILYDSTRVSFTYDETAGVLKTVNLQSDGFICTIRYRQIGPLIDRQIFRFSEDMVNARFD  
 YSYDNSFRVTSMQVINETPLPIDLYQFDDISGKVEQFGKFGVIYYDINQIISTAVMTYT  
 KHFDAGRIKEIQYEIFRSLMYWITIYQDNMGRVTKREIKIGPFANTTKYAYEYDVGQL  
 QTVYLNKIMWRNYNDLGNLHLLNPSNSARLTPLRYDLRDRITRLGDVQYRLDEDGFLR  
 QRGTEIFEYSSKGLLTRVYSKSGSWTVIYRYDGLGRRVSSKTSLGQHLQFFYADLTYPTR  
 ITHVYNHSSSEITSLYYDLQGHLFAMEISSGDEFYIASDNTGTPLAVFSSNGLMLKQIQY  
 TAYGEIYFDSNIDQLVIGFHHGLYDPLTKLIHFGERDYDILAGRWTTPDIEIWKRIKGD  
 PAPFNLYMFRNNNPASKIHDVKDYITDVNSWLVTFGFHLHNAIPGFPPVKFDLTPESEYEL  
 VKSQQWDDIPPIFGVQQQVARQAKAFLSLGKMAEVQVSRRRAGGAQSWLWFATVKSLLIGK  
 GVMLAVSQGRVQTNVLNIANEDCIKVAAVLNNAFYLENLHFTIEGKDTHYFIKTTTPESD  
 LGTLRLTSGRKALENGINVTVSQSTTVVNGRTRRFADVEMQFGALALHVRYGMTLDEEKA  
 RILEQARQALARAWAREQQRVRDGEEGARLWTEGEKRQLLSAGKVQGYDGYVLSVEQY  
 PELADSANNIQFLRQSEIGRR

The full amino acid sequence of the protein of the invention was found to have 2664 of 2721 amino acid residues (97%) identical to, and 2697 of 2721 amino acid residues (99%) similar to, the 2715 amino acid residue ptrn:SPTREMBL-ACC:Q9WTS6 protein from *Mus musculus* (Mouse) (TEN-M3).

5 The TEN-M3-like gene disclosed in this invention is expressed in at least the following tissues: adrenal gland, bone marrow, brain - amygdala, brain - cerebellum, brain - hippocampus, brain - substantia nigra, brain - thalamus, brain -whole, fetal brain, fetal kidney, fetal liver, fetal lung, heart, kidney, lymphoma - Raji, mammary gland, pancreas, pituitary gland, placenta, prostate, salivary gland, skeletal muscle, small intestine, spinal cord, spleen,  
 10 stomach, testis, thyroid, trachea and uterus.

The nucleic acids and proteins of the invention have applications in the diagnosis and/or treatment of various diseases and disorders. For example, the compositions of the present invention will have efficacy for the treatment of patients suffering from: CNS disorders, neuronal developmental disorders, heart diseases such as stroke, myocardial  
 15 infarction, ischemia, cancer, localized and systemic scleroderma, pleural inflammatory and fibrotic diseases as well as other diseases, disorders and conditions.

NOV15c

A disclosed NOV15c nucleic acid of 8473 nucleotides (also referred to as CG55069-03) (SEQ ID NO:39) encoding a novel TEN-M3-like protein is shown in Table 15E. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 258-260 and ending with a TAA codon at nucleotides 8142-8144. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined and the start and stop codons are in bold in Table 15E.

Table 15E. NOV15c nucleotide sequence (SEQ ID NO:39)
<u>TTGACAGAAAAAGGCAGTAAACGGGGAATCTCTTTTGAATAAAGAAGAAGAAGAAAT</u> <u>AAAGTACCTGTCATCTTGACAAGTGGCGGAGCGGAGGAGTCAAGGATTATAAATGATCAC</u> <u>AGCCAGGTCCAGCTCGCCCCGTGATTGGGCTCTCCGCGATCTGCACCGGGGAAGCGCA</u> <u>TGAGAGGCCAATGAGACTTGAACCCTGAGCCTAAGTTGTACCAGCAGGACTGATGTGCA</u> <u>CACAGAAGGAATGAAGTATGGATGTGAAAGAACGCAGGCCTTACTGCTCCCTGACCAAGA</u> <u>GCAGACGAGAGAAGGAACGGCGCTACACAAATTCTCCGCAGACAATGAGGAGTGCCGGG</u> <u>TACCCACACAGAAGTCTACAGTTCAGCGAGACATTGAAAGCTTTTGATCATGATTCTT</u> <u>CGCGGCTGCTTTACGGCAACAGAGTGAAGGATTTGGTTCACAGAGAAGCAGACGAGTTCA</u> <u>CTAGACAAGAGCAACCTGCAAGCAATCAAGGCCAGTCTACCCTGCAGCCCTTGCCGCTT</u> <u>CCCATAAGCAGCACTCTGCACAGCATCATCCATCCATCACTTCTCTCAACAGAACTCCC</u> <u>TGACCAATAGAAGGAACAGAGTCCGGCCCCGCGGCTGCTTTGCCCGCCGAGCTGCAAA</u> <u>CCACACCCGAGTCCGTCCAGCTGCAGGACAGCTGGGTCTTGGCAGTAATGTACCACTGG</u> <u>AAAGCAGGCATTCTCTATTCAAACAGGAACAGGTACAACGCCACTGTTCACTACTGCAA</u> <u>CCCCAGGATACACAATGGCATCTGGCTCTGTTTATTACCACTACTCGGCCACTACCTA</u> <u>GAAACACCCCTATCAAGAAGTGCTTTTAAATTCAAGAAGTCTTCAAAGTACTGTAGCTGGA</u> <u>AATGCACTGCCTGTGTGCCGTAGGGGTCTCGGTGCTCTGGCAATACTCCTGTCTTATT</u> <u>TTATAGCAATGCATCTCTTTGGCCTCAACTGGCAGCTACAGCAGACTGAAAATGACACAT</u> <u>TTGAGAATGGAAAAGTGAATTCTGATACCATGCCAACAACTGTGTCTTACCTTCTG</u> <u>GAGACAATGGAAAATTAGGTGGATTTACGCAAGAAAATAACACCATAGATTCCGGAGAAC</u> <u>TTGATATTGGCCGAAGAGCAATTCAAGAGATTCTCCCGGATCTTCTGGAGATCACAGC</u> <u>TCTTCATTGATCAGCCACAGTTTCTTAAATTCAATATCTCTTTCAGAAGGATGCATTGA</u> <u>TTGGAGTATATGGCCGGAAGGCTTACCGCCTTCCCATACTCAGTATGACTTCGTGGAGC</u> <u>TCCTGGATGGCAGCAGGCTGATTGCCAGAGAGCAGCGGAGCCTGCTTGAGACGGAGAGAG</u> <u>CCGGGCGGCAGGCGAGATCCGTACGCCCTCATGAGGCCGGCTTTATCCAGTACTTGGATT</u> <u>CTGGAATCTGGCATCTGGCTTTTTATAATGATGGGAAAATGCAGAGCAGGTGTCTTTTA</u> <u>ATACCATTGTTATAGAGTCTGTGGTGGAAATGTCCCCGAAATTGCCATGGAAATGGAGAAT</u> <u>GCGTTTCTGGAATTGCCATTGTTTTCCAGGATTTCTGGGTCCGGATTGTTCAAGAGCCG</u> <u>CCTGTCCAGTGTTATGTAGTGGAACGGGCAGTACTCCAAGGGCCGCTGCCTGTGTTTCA</u> <u>GCGGCTGGAAGGGCACCGAGTGTGATGTGCCGACTACCAAGTGTATTGACCCACAGTGTG</u> <u>GGGGTCTGGGATTTGTATCATGGGCTCTTGTGCTTGCAACTCAGGATACAAAGGAAAAA</u> <u>GTTGTGAAGAAGCTGACTGTATAGACCCTGGGTGTTCTAATCATGGTGTGTATCCACG</u> <u>GGGAATGTCACTGCAGTCCAGGATGGGGAGGTAGCAATTGTGAAATACTGAAGACCATGT</u> <u>GTCCAGACCAGTGCTCCGGCCACGGAACGTATCTTCAAGAAAGTGGCTCCTGCACGTGTG</u> <u>ACCCTAACTGGACTGGCCAGACTGCTCAAACGAAATATGTTCTGTGGACTGTGGCTCAC</u> <u>ACGGCGTTTGCATGGGGGGACGTGTGCTGTGAAGAAGGCTGGACGGGCCCAGCCTGTA</u> <u>ATCAGAGAGCCTGCCACCCCGCTGTGCCGAGCACGGGACCTGCAAGGATGGCAAGTGTG</u> <u>AATGCAGCCAGGGCTGGAATGGAGAGCACTGCACTATCGCTCACTATTTGGATAAGATAG</u> <u>TTAAAGACAAGATAGGATATAAAGAGGGTTGTCTGGTCTGTGCAACAGCAATGGAAGAT</u> <u>GTACCCTGGACCAAAATGGCGGACATTGTGTGTGCCAGCCTGGATGGAGAGGAGCAGGCT</u> <u>GTGACGTAGCCATGGAGACTCTTTGACAGATAGCAAGGACAATGAAGGGGATGGACTCA</u> <u>TTGACTGCATGGATCCCGATTGCTGCCTACAGAGTTCCTGCCAGAATCAGCCCTATTGTC</u> <u>GGGGACTGCCGATCCTCAGGACATCATTAGCCAAAGCCTTCAATCGCCTTCTCAGCAAG</u> <u>CTGCCAAATCCTTTTATGATCGAATCAGTTTCTTATAGGATCTGATAGACCCATGTTA</u> <u>TACCTGGAGAAAGTCCTTTCAATAAGAGCCTTGATCTGTCTATCAGAGGCCAAGTACTGA</u> <u>CTGCTGATGGAATCCACTTATTGGAGTAAATGTCTCGTTTTTCCATTACCCAGAATATG</u>

GATATACTATTACCCGCCAGGACGGAATGTTGACTTGGTGGCAAATGGTGGGGCCTCTC  
 TAACTTTTGGTATTTGAACGATCCCCATTCTCACTCAGTATCATACTGTGTGGATTCCAT  
 GGAATGTCTTTTATGTGATGGATACCCTAGTCATGGAGAAAGAAGAGAATGACATTTCCA  
 GCTGTGATCTGAGTGGATTTCGTGAGGCCAAATCCCATCATTGTGTGCATCACCTTTATCCA  
 CCTTTTTCAGATCTTCTCCTGAAGACAGTCCCATCATTCCCGAAACACAGGTACTCCACG  
 AGGAAACTACAATCCAGGAACAGATTTGAAACTCTCCTACTTGAGTTCCAGAGCTGCAG  
 GGTATAAGTCAGTTCTCAAGATCACCATGACCCAGTCTATTATTCCATTTAATTTAATGA  
 AGGTTTCATCTTATGGTAGCTGTAGTAGGAAGACTCTTCCAAAAGTGGTTTCTGCCTCAC  
 CAACTTGGCCTATACCTTTCATATGGGATAAAAACAGATGCATATAATCAGAAAGTCTATG  
 GTCTATCTGAAGCTGTTGTGTGAGTTGGATATGAGTATGAGTCGTGTTTGGACCTGACTC  
 TGTGGGAAAAGAGGACTGCCATTCTGCAGGGCTATGAATTGGATGCGTCCAACATGGGTG  
 GCTGGACATTAGATAAAACATCACGTGCTGGATGTACAGAACGGTATACTGTACAAGGGAA  
 ACGGGGAAAACAGTTCTCTCCAGCAGCCTCCAGTCGTGAGTAGCATCATGGGCAATG  
 GCGAAGGCGCAGCATTTCTGCCCCAGTTGCAATGGTCAAGCTGATGGTAACAAGTTAC  
 TGGCCCCAGTGGCGCTAGCTTGTGGGATCGATGGCAGTCTGTACGTAGGCGATTTCAACT  
 ACGTGGCGGCGATATTTCCCTTCTGGAATGTAAACAAGTGTCTTAGAACTAAGAAATAAG  
 ATTTTAGACATAGCAGCAACCCAGTCTATAGATACTACCTTGCAACGGATCCAGTCACGG  
 GAGATCTGTACGTTTCTGACACAAACACCCGCAGAATTTATCGCCCAAAGTCACTTACGG  
 GGGCAAAAGACTTGACTAAAAATGCAGAAGTCGTGCGAGGGACAGGGGAGCAATGCCTTC  
 CGTTTGACGAGGCGAGATGTGGGGATGGAGGGAAGCCGTGGAAGCCCACTCATGAGTC  
 CCAAAGGAATGGCAGTTGATAAGAATGGATTAACTTACTTTGTTGATGGAACCATGATTA  
 GGAAAGTTGACCAAAATGGAATCATATCAACTCTTCTGGGCTCTAACGATTTGACTTCAG  
 CCAGACCTTTAACTTGTGACACCAGCATGCACATCAGCCAGGTACGTCTGGAATGGCCCA  
 CTGACCTAGCCATTAACCTATGGATAACTCCATTATGTCTGGATAATAATGTAGTTT  
 TACAGATCACTGAAAATCGTCAAGTTTCGCATTGCTGCTGGACGGCCCATGCACTGTGAGG  
 TTCCCGGAGTGGAAATATCCTGTGGGGAAGCAGCGGTGCAGACAACACTGGAATCAGCCA  
 CTGCCATTGCTGTGTCTTACAGTGGGGTCTGTACATTACTGAACTGATGAGAAGAAAA  
 TTAACCGGATAAGGCAGGTACAAACAGATGGAGAAATCTCCTTAGTGGCCGGAATACCTT  
 CAGAGTGTGACTGCAAAAATGATGCCAACTGTGACTGTTACCAGAGTGGAGATGGCTACG  
 CCAAGGATGCCAAACTCAGTGGCCCATCCTCCCTGGCTGCTTCTCCAGATGGTACACTGT  
 ATATTGCAGATCTAGGGAATATCCGGATCCGGGCTGTGTCAAAGAATAAGCCTTTACTTA  
 ACTCTATGAACTTCTATGAAGTTGCGTCTCCAAGTATCAAGAACTCTACATCTTTGACA  
 TCAATGGTACTCACCAATATACTGTAAGTTTAGTCACTGGTGATTACCTTTACAATTTTA  
 GCTACAGCAATGACAATGATATTACTGCTGTGACAGACAGCAATGGCAACACCCCTTAGAA  
 TTAGACGGGACCCAAATCGCATGCCAGTTTCGAGTGGTGTCTCCTGATAACCAAGTGATAT  
 GGTGACAATAGGAACAAATGGATGTTTGAAAGGCATGACTGCTCAAGGACTGGAATTAG  
 TTTTGTTTACTTACCATGGCAATAGTGGCCTTTTAGCCACTAAAAGTGATGAACTGGAT  
 GGACAACGTTTTTTGACTATGACAGTGAAGGTCGTCTGACAAATGTTACGTTTCCAAGT  
 GAGTGGTCACAAACCTGCATGGGGACATGGACAAGGCTATCACAGTGGACATTGAGTCAT  
 CTAGCCGAGAAGAAGATGTGAGCATCACTTCAAATCTGTCTCGATCGATTCTTTCTACA  
 CCATGGTTCAAGATCAGTTAAGAAACAGCTACCAGATTGGTTATGACGGCTCCCTCAGAA  
 TTATCTACGCCAGTGGCCTGGACTCACACTACCAACAGAGCCGACGTTCTGGCTGGCA  
 CCGCTAATCCGACGGTTGCCAAAAGAACATGACTTTGCCTGGCGAGAACGGTCAAAACT  
 TGGTGGAAATGGAGATTCCGAAAAGAGCAAGCCCAAGGGAAGTCAATGTCTTTGGCCGCA  
 AGCTCAGGGTTAATGGCAGAAACCTCCTTTGAGTTGACTTTGATCGAACAACAAAGACAG  
 AAAAGATCTATGACGACCACCGTAAATTTCTACTGAGGATCGCCTACGACACGTCTGGGC  
 ACCCGACTCTCTGGCTGCCAAGCAGCAAGCTGATGGCCGTCAATGTACCTATTTCATCCA  
 CAGGTCAAATTGCCAGCATCCAGCGAGGCCACCTAGCGAGAAAGTAGATTATGACGGAC  
 AGGGGAGGATCGTGTCTCGGGTCTTTGCTGATGGTAAAACATGGAGTTACACATATTTAG  
 AAAAGTCCATGGTTCTTCTGCTTCATAGCCAGCGGCAGTACATCTTGAATACGATATGT  
 GGGACCGCCTGTCTGCCATCACCATGCCAGTGTGGCTCGCCACACCATGCAGACCATCC  
 GATCCATTGGCTACTACCGCAACATATACAACCCCCGAAAGCAACGCCTCCATCATCA  
 CGGACTACAACGAGGAAGGGCTGCTTCTACAAACAGCTTTCTTGGGTACAAGTCGGAGGG  
 TCTTATTCAAATACAGAAGGCAGACTAGGCTCTCAGAAATTTTATATGATAGCACAAAGAG  
 TCAGTTTTACCTATGATGAAACAGCAGGAGTCTTAAAGACAGTAAACCTCCAGAGTGATG  
 GTTTTATTTGCACCATTAGATACAGGCAAATGGTCCCCTGATTGACAGGCAGATTTTCC  
 GCTTTAGTGAAGATGGGATGGTAAATGCAAGATTTGACTATAGCTATGACAACAGCTTTC  
 GAGTGACCAGCATGCAGGGTGTGATCAATGAAACGCCACTGCCATTGATCTGTATCAGT  
 TTGATGACATTTCTGGCAAAGTTGAGCAGTTTGGAAAGTTTGGAGTTATATATTATGATA  
 TTAACCAAGATCATTTCTACAGCTGTAATGACCTATACGAAGCACTTTGATGCTCATGGCC  
 GTATCAAGGAGATTCAATATGAGATATTAGGTGCTCATGTACTGGATTACAATTGAGT  
 ATGATAACATGGGTGCGGTAACCAAGAGAGAGATTAAAATAGGGCCCTTTGCCAACACCA

CCAAATATGCTTATGAATATGATGTTGATGGACAGCTCCAAACAGTTTACCTCAATGAAA  
 AGATAATGTGGCGGTACAACCTACGATCTGAATGGAAACCTCCATTTACTGAACCCAAGTA  
 ACAGTGCGCGTCTGACACCCCTTCGCTATGACCTGCGAGACAGAATCACTCGACTGGGTG  
 ATGTTCAATATCGGTTGGATGAAGATGGTTTCTACGTCAAAGGGGCACGGAAATCTTG  
 AATATAGCTCCAAGGGGCTTCTAACTCGAGTTTACAGTAAAGGCAGTGGCTGGACAGTGA  
 TCTACCGTTATGACGGCCTGGGAAGGCGTGTCTAGCAAAACCAGTCTAGGACAGCACC  
 TGAGTTTATGCTGACTTAACCTTATCCCACTAGGATTACTCATGTCTACAACCATT  
 CGAGTTCAGAAATTACCTCCCTGTATTATGATCTCCAAGGACATCTTTTGGCCATGGAAA  
 TCAGCAGTGGGGATGAATTCTATATTGCATCGGATAACACAGGGACACCACTGGCTGTGT  
 TCAGTAGCAATGGGCTTATGCTGAAACAGATTCACTACACTGCATATGGGGAATCTATT  
 TTGACTCTAATATTGACTTTCACTGGTAATTGGATTTCATGGTGGCCTGTATGACCCAC  
 TCACCAAATTAATCCACTTTGGAGAAAGAGATTATGACATTTTGGCAGGACGGTGGACAA  
 CACCTGACATAGAAATCTGGAAAAGAATTGGGAAGGACCCAGCTCCTTTAACTTGTACA  
 TGTTTAGGAATAACAACCTGCAAGCAAAATCCATGACGTGAAAGATTACATCACAGATG  
 TTAACAGCTGGCTGGTGACATTTGGTTTCCATCTGCACAATGCTATTCTTGGATTCCCTG  
 TTCCCAAATTTGATTTAACAGAACCTTCTTACGAACTTGTGAAGAGTCAGCAGTGGGATG  
 ATATACCGCCCATCTTCGGAGTCCAGCAGCAAGTGGCGCGGCGAGGCCAAGGCCTTCCTGT  
 CGCTGGGGAGATGGCCGAGGTGCAGGTGAGCCGGCGCGGCGCGCGCAGTCCT  
 GGCTGTGGTTCGCCACGGTCAAGTCGCTGATCGGCAAGGGCGTCATGCTGGCCGTGAGCC  
 AGGGCCGCTGCAGACCAACGTGCTCAACATCGCCAACGAGGACTGCATCAAGGTGGCGG  
 CCGTGCTCAACAACGCCTTCTACCTGGAGAACCTGCACCTTACCATCGAGGGCAAGGACA  
 CGCACTACTTCATCAAGACCACCAAGCCGAGAGCGACCTGGGCACGCTGCGGTTGACCA  
 GCGGCCGCAAGGCGCTGGAGAACGGCATCAACGTGACGGTGTGCGAGTCCACCACGGTGG  
 TGAACGGCAGGACGCGCAGGTTTCGCGACGTGGAGATGAGTTCGCGCGCTGGCGCTGC  
 ACGTGCGCTACGGCATGACCTTGGACGAGGAGAAGCGCGCATCCTGGAGCAGGCGCGG  
 AGCGCGCGCTCGCCCGGGCCTGGGCGCGGAGCAGCAGCGCTGCGCGACGCGAGGAGG  
 GCGCGCGCTCTGGACGAGGGCGAGAAGCGGCAGCTGCTGAGCGCGGCAAGGTGAGG  
 GCTACGACGGTACTACGTACTCTCGGTGGAGCAGTACCCGAGCTGGCCGACAGCGCCA  
 ACAACATCCAGTTCCTGCGGCAGAGCGAGATCGGCAGGAGGTAACGCCCGGGCCGCGCCC  
 GCGGAGCGCTCAGCCCTGCCACATTTGTCCTGTGGCACAACCCGAGTGGGACTCTCCA  
 ACGCCCAAGAGCCTTCTCCCGGGGGAATGAGACTGCTGTTACGACCCACACCCACACCG  
 CGAAAACAAGGACCGCTTTTTTCCGAATGACCTTAAAGTGATCGGCTTTAACGAATATG  
 TTTACATATGCATAGCGCTGCACTCAGTCCGACTGAACGTAGCCAGAGGAAAAAAATC  
 ATCAAGGACAAAGGCCTCGACCTGTTGCGCTGGGCCGTCTGTTCTTCTAGGCACTGTAT  
 TTAATAACTTTA

The TEN-M3 NOV15c disclosed in this invention maps to chromosome 4.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 5395 of 6175 bases (87%) identical to a gb:GENBANK-

5 ID:AB025412|acc:AB025412.1 mRNA from Mus musculus (Mus musculus mRNA for Ten-m3, complete cds).

A disclosed NOV15c polypeptide (SEQ ID NO:40) encoded by SEQ ID NO:39 has 2628 amino acid residues and is presented in Table 15F using the one-letter code. NOV15c seems to be a Type II (Ncyt Cexo) membrane protein with an INTEGRAL Likelihood of -9.39  
 10 for Transmembrane 216 - 232 (212 - 244). Although PSORT suggests that the TEN-M3-like protein may be localized in the nucleus, the protein of CuraGen Acc. No. CG55069-03 predicted here is similar to the membrane protein family, some members of which are secreted or are membrane bound. Therefore it is likely that this novel TEN-M3-like protein shows similar localization. The SignalP, Psort and/or Hydropathy results predict that NOV15c has

no signal peptide and is likely to be localized in the nucleus with a certainty of 0.8000. In an alternative embodiment, NOV15c is likely to be localized to the plasma membrane with a certainty of 0.7900, or to the microbody (peroxisome) with a certainty of 0.3577, or to the Golgi body with a certainty of 0.3000.

5

Table 15F. NOV15c protein sequence (SEQ ID NO:40)

MDVKERRPYCSLTKSRREKERRYTNSSADNEECRVPTQKSYSSSETLKAFDHDSSRLLYG NRVKDLVHREADEFTTRQEQPASNQGGSTLQPLPPSHKQHSQAQHHPSITSLNRNSLTNRRN QSPAPPAALPAELQTTPEVQLQDSWVLGSNVPLESRHFLFKTGTGTPLFSTATPGYTM ASGSVYSPPTRPLPRNTLSRSAFKFKKSSKYCSWKCTALCAVGVSLLAILLSYFIAMHL FGLNWQLQQTENDTFENGKVNSDTMTNTVSLPSGDNGKLGFTQENNTIDSGELDIGRR AIQEIPPGIFWRSQFLIDQPQLKFNISLQKDALIGVYGRKGLPPSHTQYDFVELLDGSR LIAREQRSLLETERAGRQARSVSLHEAGFIQYLDSGIWHLAFYNDGKNAEQVSFNTIVIE SVVECPRNCHGNGECVSGTCHCFPGFLGPDCSRACPVLCSGNGQYSKGRCLCFSGWKGT ECDVPTTQCIDPQCGGRGICIMGSCACNSGYKGKSCCEADCIDPGCSNHGVCIHGECHCS PGWGGSNCEILKTMCPDQCSGHGTYLQESGSCDNPWTGPDCSNEICSVDCGSHGVCMG GTCRCEEGWTGPACNQRACHPRCAEHGTCKDGKCECSQGWNGEHCTIAHYLDKIVKDKIG YKEGCPGLCNSNGRCTLQDNGHCVCQPGWRGAGCDVAMETLCTDSKDNEGDGLIDCMDP DCCLQSSCQNPYCRGLPDPQDIISQSLQSPSQQAASFYDRISFLIGSDSTHVIPGESF FNKSLASVIRGQVLTADGTPLIGVNVSFHYPEGYTTITRODGMFDLVANGASLTLVFE RSPFLTQYHTVWIPWNVFYVMDTLVMEKEENDIPSCDLSGFVRPNPIIVSSPLSTFFRSS PEDSPIIPETQVLHEETTIPGTDLKLSSRAAGYKSVLKITMTQSIIPFNLMKVHLMV AVVGRLFQKWFPASPNLAYTFIWDKTDAYNQKVYGLSEAVVSVGYEYESCLDLTLWEKRT AILQGYELDASNMGWTLDKHHVLDVQNGILYKNGENQFISQPPVVSSIMGNRRRSI SCPSCNGQADGNKLLAPVALACGIDGSLYVGDFNYVRRIFPSGNVTSVLELRNKDFRHSS NPAHRYLATDPVTGDLYVSDTNTTRRIYRPKSLTGAKDLTKNAEVVAGTGEQCLPFDEAR CGDGGKAVEATLMSPKGMAVDKNGLIYFVDGTMIRKVDQNGIISTLLGSNDLTSARPLTC DTSMHISQVRLEWPTDLAINPMDNSIYVLDNNVVLQITENRQVRIAAGRPMHCQVPVGEY PVGKHAVQTTLSESATAIAVSYSYGVLYITETDEKKINRIRQVTTDGEISLVAGIPSECDCK NDANCDQYQSGDGYAKDAKLSAPSSLAASPDGTLTYIADLGNIRIRAVSKNKPILLNSMNFY EVASPTDQELYIFDINGTHQYTVSLVTGDYLYNFSYSNDNDITAVTDSNGNTLRIRDPN RMPVRVSPDNQVIWLTIGTNGCLKGMTAQGLELVLFYHGNSSGLLATKSDETGWTTFFD YDSEGRLTNVFTPTGVVTNLHGMDKAITVDIESSSREEDVSITSNLSSIDSFYTMVQDQ LRNSYQIGYDGLRIIYASGLDSHYQTEPHVLAGTANPTVAKRNMTPGENGQNLVEWRF RKEQAQGGKVNVRGRKLRVNGRNLLSVDFDRTTKTEKIYDDHRKFLLRIAYDTSGHPTLWL PSSKLMVNVVYSSSTGQIASIQRTTSEKVDYDQGGRIVSRVFADGKTWSYTYLEKSMVL LLHSQRQYIFEYDMWDRLSAITMPSVARHTMQTIRSIGYRNIYNPPESNASIITDYNEE GLLLQTAFLGTSRRVLFKYRRQTRLSEILYDSTRVSFTYDETAGVLKTVNLQSDGFICTI RYRQIGPLIDRQIFRFSEDGMVNARFDYSYDNSFRVTSMQGVINETPLPIDLYQFDDISG KVEQFGKFGVIYYDINQIISTAVMTYTKHFDAGRIKEIQYEIFRSLMYWITIYQDNMGR VTKREIKIGPFANTTKYAYEYDVGQLQTVYLNEKIMWRYNYDLNGLHLLNPSNSARLT PLRYDLRDRITRLGDVQYRLDEDGFLRQRGTEIFEYSSKGLLTVYSKSGSGWTVIYRYDG LGRRVSSKTSLGQHLQFFYADLTYPTRITHVYNHSSSEITSLYYDLQGHLFAMEISSGDE FYIASDNTGTPLAVFSSNGLMLKQIQYTAYGEIYFDSNIDFQLVIGFHGGLYDPLTKLIH FGERDYDILAGRWTTPDIEIWKIRIGDPAPFNLYMFRNNNPASKIHDVKDYITDVNSWL TFGFHLHNAIPGFPVPKFDLTPEPSYELVKSQQWDDIPPIFGVQQQVARQAKAFLSLGKMA EVQVSRRRAGGAQSWLWFATVKSLIGKVMGLAVSQGRVQTNVLNLANEDCIKVAAVLNNA FYLENLHFTIEGKDTYFIKTTTPESDLGLRLTSGRKALENGINVTVSQSTTVVNGRTR RFADVEMQFGALALHVRYGMTLDEEKARILEQARQALARAWAREQQRVRDGEEGARLWT EGEKRQLLSAGKVQGYDGYVLSVEQYPELADSANNIQFLRQSEIGRR
--

The full amino acid sequence of the protein of the invention was found to have 2505 of 2575 amino acid residues (97%) identical to, and 2537 of 2575 amino acid residues (98%)

similar to, the 2715 amino acid residue ptnr:SPTREMBL-ACC:Q9WTS6 protein from Mus musculus (Mouse) (TEN-M3).

The TEN-M3-like gene disclosed in this invention is expressed in at least the following tissues: adrenal gland, bone marrow, brain - amygdala, brain - cerebellum, brain - hippocampus, brain - substantia nigra, brain - thalamus, brain -whole, fetal brain, fetal kidney, fetal liver, fetal lung, heart, kidney, lymphoma - Raji, mammary gland, pancreas, pituitary gland, placenta, prostate, salivary gland, skeletal muscle, small intestine, spinal cord, spleen, stomach, testis, thyroid, trachea and uterus.

The nucleic acids and proteins of the invention have applications in the diagnosis and/or treatment of various diseases and disorders. For example, the compositions of the present invention will have efficacy for the treatment of patients suffering from: CNS disorders, neuronal developmental disorders, heart diseases such as stroke, myocardial infarction, ischemia, cancer, localized and systemic scleroderma, pleural inflammatory and fibrotic diseases as well as other diseases, disorders and conditions.

## NOV15d

A disclosed NOV15d nucleic acid of 8487 nucleotides (also referred to as CG55069-08) (SEQ ID NO:41) encoding a novel TEN-M3-like protein is shown in Table 15G. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 299-301 and ending with a TAA codon at nucleotides 8138-8140. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined and the start and stop codons are in bold in Table 15G.

**Table 15G. NOV15d nucleotide sequence (SEQ ID NO:41)**

ACTCACTATAGGGCTCGAGCGGCCCGGGCAGGTCCCATTGACAGAAAAAGGCAGTAAACGGGGAAT
CTCTTTTGTGAATAAAGAAGAAGAATAAAGTACCTGTCATCTTGACAAGTGGCGGAGCGGAGGAG
TCAAGGATTATAAATGATCAGCCAGGTCCAGCTCGCCCCGTGATTGGGCTCTCCCGCGATCTGCACCG
GGGGAAGCGCATGAGAGGCCAATGAGACTTGAACCTGAGCCTAAGTTGTCACCAGCAGGACTGATGTGC
ACACAGAAGGAATGAAGTATGGATGTGAAAGAACGCAGGCCTTACTGCTCCCTGACCAAGAGCAGACGAG
AGAAGGAACGGCGCTACACAAATTCCTCCGCAGACAATGAGGAGTGCCGGGTACCCACACAGAAGTCCTA
CAGTTCAGCGAGACATTGAAAGCTTTTGATCATGATTCCTCGCGGCTGCTTTACGGCAACAGAGTGAAG
GATTTGGTTCACAGAGAAGCAGACGAGTTCAC TAGACAAGAGCAACCTGCAAGCAATCAAGGCCAGTCTA
CCCTGCAGCCCTTGCCGCCTTCCCATAGCAGCACTCTGCACAGCATCATCCATCCATCACTTCTCTCAA
CAGAACTCCCTGACCAATAGAAGGAACAGAGTCCGGCCCCCGCGGCTGCTTTGCCCGCCGAGCTGCAA
ACCACACCCGAGTCCGTCCAGCTGCAGGACAGCTGGGTCTTGGCAGTAATGTACCACTGGAAAGCAGGC
ATTTCTTATCAAAACAGGAACAGGTACAACGCCACTGTTCACTACTGCAACCCCAAGGATACACAATGGC
ATCTGGCTCTGTTTATTACCACTACTCGGCCACTACCTAGAAACACCTATCAAGAAGTGCTTTTAAA
TTCAAGAAGTCTTCAAAGTACTGTAGCTGGAAATGCACTGCACTGTGTGCCGTAGGGGTCTCGGTGCTCC
TGGCAATACTCCTGTCTTATTTATAGCAATGCATCTTTGGCCTCACTGGCAGCTACAGCAGACTGA
AAATGACACATTTGAGAATGGAAGTGAATTCGTATACCATGCCAACAACTGTGTCTTACCTTCT
GGAGACAATGGAAAATTAGGTGGATTACGCAAGAAAATAACACCATAGATTCCGGAGAAGTTGATATTG

GCCGAAGAGCAATTCAAGAGATTCTCCCGGGATCTTCTGGAGATCACAGCTCTTCATTGATCAGCCACA  
GTTTCTTAAATTCAATATCTCTTTCAGAAGGATGCATTGATTGGAGTATATGGCCGGAAGGCTTACCG  
CCTTCCCATACTCAGTATGACTTCGTGGAGCTCCTGGATGGCAGCAGGCTGATTGCCAGAGAGCAGCGGA  
GCCTGCTTGAGACGGAGAGAGCCGGGCGGCAGGCGAGATCCGTAGCCTTCATGAGGCCGGCTTTATCCA  
GTACTTGGATTCTGGAATCTGGCATCTGGCTTTTTATAATGATGGGAAAAATGCAGAGCAGGTGTCTTTT  
AATACCATTGTTATAGAGTCTGTGGTGAATGTCCCCGAAAATTGCCATGGAAATGGAGAATGCGTTTCTG  
GAACTTGCCATTGTTTTCCAGGATTTCTGGGTCCGGATTGTTCAAGAGCCGCTGTCCAGTGTATGTAG  
TGGCAACGGGCAGTACTCCAAGGGCCGCTGCCTGTGTTTCAGCGGCTGGAAGGGCACCGAGTGTGATGTG  
CCGACTACCCAGTGTATTGACCCACAGTGTGGGGTCTGGGATTTGTATCATGGGCTCCTGTGCTTGCA  
ACTCAGGATACAAAGGAGAAAGTTGTGAAGAAGCTGACTGTATAGACCCTGGGTGTTCTAATCATGGTGT  
GTGTATCCACGGGAATGTCACTGCAGTCCAGGATGGGAGGTAGCAATTGTGAAATACTGAAGACCATG  
TGTCCAGACCAGTGTCTCCGGCCACGGAACGTATCTTCAAGAAAGTGGCTCCTGCACGTGTGACCTAACT  
GGACTGGCCAGACTGCTCAAACGAAATATGTTCTGTGGACTGTGGCTCACACGGCGTTTGCATGGGGG  
GACGTGTGCTGTGAAGAAGGCTGGACGGGCCCCAACCTGTAATCAGAGAGCCTGCCACCCCGCTGTGCC  
GAGCACGGGACCTGCAAGGATGGCAAGTGTGAATGCAGCCATGGCTGGAATGGAGAGCATGCATATCG  
AGGTTTGTCTGCTGTGCAACCAATGGAAGATGTACCCTGGACCAAAATGGCTGGCATTGTGTGTG  
CCAGCCTGGATGGAGAGGAGCAGGCTGTGACGTAGCCATGGAGACTCTTTCACAGATAGCAAGGACAAT  
GAAGGAGATGGACTCATTGACTGCATGGATCCCGATTGTGCTCCTACAGAGTCTGCGCAGAATCAGCCCT  
ATTGTGCGGGACTGCCGGATCCTCAGGACATCATTAGCCAAAGCCTTCAATCGCCTTCTCAGCAAGCTGC  
CAAATCCTTTTATGATCGAATCAGTTTCCTTATAGGATCTGATAGCACCCATGTTATACCTGGAGAAAGT  
CCTTTCAATAAGAGCCTTGCATCTGTCTCATCAGAGGCCAAGTACTGACTGCTGATGGAATCCACTTATTG  
GAGTAAATGTCTCGTTTTTCCATTACCCAGAATATGGATATACTATTACCCGCCAGGACGGAATGTTGA  
CTTGGTGGCAAATGGTGGGGCTCTCTAACTTTGGTATTTGAACGATCCCATTCCTCACTCAGTATCAT  
ACTGTGTGGATTCCATGGAATGTCTTTATGTGATGGATAACCTAGTCATGGAGAAAGAAAGAAATGACA  
TTCCAGCTGTGATCTGAGTGGATTCTGTGAGGCCAAATCCCATCATTGTGTCTACACCTTTATCCACCTT  
TTTCAGATCTTCTCCTGAAGACAGTCCCATCATTCCCGAAACACAGGTAATCCACGAGGAAACTACAATT  
CCAGGAACAGATTGAAACTCTCCTACTTGAGTTCAGAGCTGCAGGGTATAAGTCAGTTCTCAAGATCA  
CCATGACCCAGTCTATTATTCCATTTAATTTAATGAAGGTTTCATCTTATGGTAGCTGTAGTAGGAAGACT  
CTTCCAAAAGTGGTTTCTGCTCCTCACCAAACCTTGGCCTATACCTTTTATATGGGATAAAACAGATGCATAT  
AATCAGAAAGTCTATGGTCTATCTGAAGCTGTTGTGTGCTGATGGATATGAGTATGAGTCGTGTTTGGACC  
TGACTCTGTGGGAAAAGAGGACTGCCATTCTGCAGGGCTATGAATTGGATGCGTCCAACATGGGTGGCTG  
GACATTAGATAAACATCACGTGCTGGATGTACAGAACGGTATACCTGTACAAGGAAACGGGGAAACAG  
TTCATCTCCCAGCAGCCTCCAGTCTGTGAGTAGCATATGGGCAATGGGCGAAGGCGCAGCATTTCTGCC  
CCAGTTGCAATGGTCAAGCTGATGGTAAACAAGTTACTGGCCCCAGTGGCGCTAGCTTGTGGGATCGATGG  
CAGTCTGTACGTAGGCGATTTCAACTACGTGCGGCGGATATTCCCTTCTGGAATGTAACAAGTGTCTTA  
GAACTAAGAAATAAAGATTTTAGACATAGCAGCAACCCAGCTCATAGATACTACCTTGCAACGGATCCAG  
TCACGGGAGATCTGTACGTTTCTGACACAAACACCCGCAAGTTTATCGCCCAAAGTCACTTACGGGGG  
AAAAGACTTGACTAAAATGCAGAAGTCTGTCGAGGGACAGGGGAGCAATGCCTTCCGTTTGACGAGGCG  
AGATGTGGGGATGGAGGGAAGGCCGTGGAAGCCACACTCATGAGTCCCAAAGGAATGGCAGTTGATAAGA  
ATGGATTAATCTACTTTGTTGATGGAACCATGATTAGGAAAGTTGACCAAAATGGAATCATATCAACTCT  
TCTGGGCTCTAACGATTGACTTCAGCCAGACCTTTAACTTGTGACACCAGCATGCACATCAGCCAGGTA  
TAGTTTACAGATCACTGAAAATCGTCAAGTTTCGATTGCTGTGAGCGGCCCATGCACTGTGAGGTTCC  
CGGAGTGAATATCCTGTGGGGAAGCACGCGGTGCAGACAACACTGGAATCAGCCACTGCCATTGCTGTG  
TCCTACAGTGGGGTCTGTACATTACTGAACTGATGAGAAGAAAATTAACCGGATAAGGCAGGTCACAA  
CAGATGGAGAAATCTCCTTAGTGGCCGGAATACCTTCAGAGTGTGACTGCAAAAATGATGCCAACTGTGA  
CTGTTACCAGAGTGGAGATGGCTACGCCAAGGATGCCAAACTCAGTGCCCCATCCTCCCTGGCTGCTTCT  
CCAGATGGTACACTGTATATTGCAGATCTAGGGAATATCCGGATCCGGGCTGTGTCAAAGAATAAGCCTT  
TACTTAACTCTATGAACCTCTATGAAGTTGCGTCTCAAACCTGATCAAGAACTCTACATCTTGACATCAA  
TGGTACTACCAATATACTGTAAGTTTGTGCTGATTACCTTTACAATTTTAGCTACAGCAATGAC  
AATGATATTACTGCTGTGACAGACAGCAATGGCAACACCTTTAGAATTAGACGGGACCCAAATCGCATGC  
CAGTTCGAGTGGTGTCTCCTGATAACCAAGTGATATGGTTGACAATAGGAACAAATGGATGTTTGAAGG  
CATGACTGCTCAAGGACTGGAATTAGTTTTGTTTACTTACCATGGCAATAGTGGCCTTTTAGCCACTAAA  
AGTGATGAAACTGGATGGACAACGTTTTTTGACTATGACAGTGAAGTTCGTCTGACAAATGTTACGTTTC  
CAACTGGAGTGGTCACAACTGCATGGGGACATGGACAAGGCTATCACAGTGGACATTGAGTCATCTAG  
CCGAGAAGAAGATGTGAGCATCACTTCAAATCTGTCTCGATCGATTCTTTCTACACCATGGTTCAAGAT  
CAGTTAAGAAAACAGCTACCAGATTGGTTATGACGGCTCCCTCAGAATTATCTACGCCAGTGGCCTGGACT  
CACACTACCAAAGAGAGCCGACGTTCTGGCTGGCACCGCTAATCCGACGGTTGCCAAAAGAAACATGAC  
TTTGCTTGGCGGAGAACGGTCAAACTTGGTGGAAATGGAGATTCCGAAAAGAGCAAGCCCCAAGGGAAAGTC  
AATGCTCTTGGCCGCAAGCTCAGGGTTAATGGCGAAAGAACTCCTTTTCAAGTTGACTTTGATCGAACAA  
AGACAGAAAAGATCTATGACGACCACCGTAAATTTCTACTGAGGATCGCCTACGACACGTCTGGGCACCC  
GACTCTCTGGCTGCCAAGCAGCAAGCTGATGGCCGTCAATGTACCTATTATCCACAGGTCAAATTGCC



AGCATCCAGCGAGGCACCACTAGCGAGAAAGTAGATTATGACGGACAGGGGAGGATCGTGTCTCGGGTCT  
TTGCTGATGGTAAAACATGGAGTTACACATATTTAGAAAAGTCCATGGTTCTTCTGCTTCATAGCCAGCG  
GCAGTACATCTTCGAATACGATATGTGGGACCGCTGTCTGCCATCACCATGCCCAGTGTGGCTCGCCAC  
ACCATGCAGACCATCCGATCCATTGGCTACTACCGCAACATATACAACCCCCGAAAGCAACGCCTCCA  
TCATCACGGACTACAACGAGGAAGGGCTGCTTCTACAACAGCTTTCTTGGGTACAAGTCCGGAGGGTCTT  
ATTCAAATACAGAAGGCAGACTAGGCTCTCAGAAAATTTTATATGATAGCACAAAGAGTCAGTTTACCTAT  
GATGAAACAGCAGGAGTCCCTAAAGACAGTAAACCTCCAGAGTGATGGTTTATTTGCACCATTAGATACA  
GGCAAATGGTCCCCTGATTGACAGGCAGATTTTCCGCTTTAGTGAAGATGGGATGGTAAATGCAAGATT  
TGACTATAGCTATGACAACAGCTTTCGAGTGACCAGCATGCAGGGTGTGATCAATGAAACGCCACTGCCT  
ATTGATCTGTATCAGTTTGATGACATTTCTGGCAAAGTTGAGCAGTTTGGAAAGTTTGGAGTTATATATT  
ATGATATTAACCAGATCATTCTACAGCTGTAATGACCTATACGAAGCACTTTGATGCTCATGGCCGTAT  
CAAGGAGATTCAATATGAGATATTAGGTCGCTCATGTACTGGATTACAATTCAGTATGATAACATGGGT  
CGGGTAACCAAGAGAGAGATTAATAAGGGCCCTTTGCCAACACCACCAATATGCTTATGAATATGATG  
TTGATGGACAGCTCCAAACAGTTTACCTCAATGAAAAGATAATGTGGCGGTACAACACGATCTGAATGG  
AAACCTCCATTACTGAACCAAGTAACAGTGCGCGTCTGACACCCCTTCGCTATGACCTGCGAGACAGA  
ATCATCTGACTGGGTGATGTTCAATATCGGTTGGATGAAGATGGTTTCTTACGTCAAAGGGGCACGGAAA  
TCTTTGAATATAGCTCCAAGGGGCTTCTAACTCGAGTTTACAGTAAAGGCAGTGGCTGGACAGTGATCTA  
CCGTTATGACGGCCTGGGAAGGCGTGTCTTAGCAAAACCAGTCTAGGACAGCACCTGCAGTTTTTTTAT  
GCTGACTTAACTTATCCCACTAGGATTACTCATGTCTACAACCATTGAGTTTCAAGAAATTACCTCCCTGT  
ATTATGATCTCCAAGGACATCTTTTGGCATGGAAATCAGCAGTGGGGATGAATTCTATATTGCATCGGA  
TAACACAGGGACACCACTGGCTGTGTTTCACTAGCAATGGGCTTATGCTGAAACAGATTGAGTACACTGCA  
TATGGGGAAATCTATTTTGAATCTAATATTGACTTCAACTGGTAATTGGATTTCATGGTGGCCTGTATG  
ACCACTCACCAAATTAATCCACTTTGGAGAAAGAGATTATGACATTTTGGCAGGACGGTGGACAACACC  
TGACATAGAAATCTGGAAGAAATGGGAAGGACCCAGCTCCTTTTAACTTGTACATGTTTAGGAATAAC  
AACCCTGCAAGCAAAATCCATGACGTGAAAGATTACATCACAGATGTTAACAGCTGGCTGGTACATTTG  
GTTTCCATCTGCACAATGCTATTCTTGGATTCCCTGTTCCCAAATTTGATTTAACAGAACCTTCTTACGA  
ACTTGTGAAGAGTCAGCAGTGGGATGATATACCGCCCATCTTCGGAGTCCAGCAGCAAGTGGCGCGCAG  
GCCAAGGCCTTCCGTGTCGTGGGGAAGATGGCCGAGGTGCAGGTGAGCCGGCGCCGGCCGGCGCGCGC  
AGTCTGGCTGTGGTTCCGCCAGGTCAAGTCTGATCGGCAAGGGCGTCTGCTGGCCGTGAGCCAGGG  
CCGCGTGCAGACCAACGTGCTCAACATCGCCAACGAGGACTGCATCAAGGTGGCGGCCGTGCTCAACAAC  
GCCTTCTACCTGGAGAACCTGCATTTACCATCGAGGGCAAGGACACGCACTACTTCATCAAGACCACCA  
CGCCGAGAGCGACCTGGGCACGCTGCGGTTGACCAGCGGCCGCAAGGCGCTGGAGAACCGCATCAACGT  
GACGGTGTGCGAGTCCACCACGGTGGTGAACGGCAGGACGCGCAGGTTTCGCGGACGTGGAGATGCAAGTTC  
GGCGCGCTGGCGCTGCAGTGCCTACGGCATGACCTGGACGAGGAGAAGGCGCGCATCCTGGAGCAGG  
CGCGGCAGCGCGCTGCGCCGGGCTGGGCGCGGAGCAGCAGCGCTGCGCGACGGCGAGGAGGGCGC  
GCGCCTCTGGACGGAGGGCGAGAAGCGGCAGTGTGAGCGCCGCAAGGTGCAGGGCTACGACGGGTAC  
TACGTAATCTCGGTGGAGCAGTACCCCGAGCTGGCCGACAGCGCCAACAACATCCAGTTTCTGCGGCAGA  
GCGAGATCGGCAGGAGGTAACGCCCCGGGCCGCGCCCGAGCCGCTCACGCCCCTGCCACATTGTCTCTG  
TGGCACAACCCGAGTGGGACTCTCCAACGCCCAAGAGCCTTCTCCCGGGGGAATGAGACTGCTGTTACG  
ACCCACACCCACACCGGAAAAACAAGGACCGCTTTTTTCCGAATGACCTTAAAGGTGATCGGCTTTAACG  
AATATGTTTACATATGCATAGCGCTGCACTCAGTCGAGTGAACGTAGCCAGAGGAAAAAATCATCA  
AGGACAAAGGCCTCGACCTGTTGCGCTGGGCCGTCTGTTCTTCTAGGCACTGTATTTAACTAACTTTAA  
AAAAAAAAAAAAAAAAAG

The TEN-M3 NOV15d disclosed in this invention maps to chromosome 4.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 5307 of 5309 bases (99%) identical to a gb:GENBANK-

5 ID:AB040888|acc:AB040888.1 mRNA from Homo sapiens (Homo sapiens mRNA for KIAA1455 protein, partial cds).

A disclosed NOV15d polypeptide (SEQ ID NO:42) encoded by SEQ ID NO:41 has 2613 amino acid residues and is presented in Table 15H using the one-letter code. NOV15d seems to be a Type II (Ncyt Cexo) membrane protein with an INTEGRAL Likelihood of -9.39  
10 for Transmembrane 216 - 232 (212 - 244). Although PSORT suggests that the TEN-M3-like

protein may be localized in the nucleus, the protein of CuraGen Acc. No. CG55069\_08 predicted here is similar to the TEN-M3 family, some members of which are membrane localized. Therefore it is likely that this novel TEN-M3-like protein is localized to the same sub-cellular compartment. The SignalP, Psort and/or Hydropathy results predict that NOV15d has no signal peptide and is likely to be localized in the nucleus with a certainty of 0.8000. In an alternative embodiment, NOV15d is likely to be localized to the plasma membrane with a certainty of 0.7900, or to the microbody (peroxisome) with a certainty of 0.3642, or to the Golgi body with a certainty of 0.3000.

**Table 15H. NOV15d protein sequence (SEQ ID NO:42)**

```
MDVKERRPYCSLTKSRREKERRYTNSSADNEECRVPTQKSYSSSETLKAFDHDSSRLLYG
NRVKDLVHREADEFTRQEQPASNQGSTLQPLPPSHKQHSQAQHPSITSLNRNSLTNRRN
QSPAPPAALPAELQTTPEVQLQDSWVLGSNPLESRHFLFKTGTGTTPLFSTATPGYTM
ASGSVYSPPTRLPRNTLSRSAFKFKKSSKYCSWKCTALCAVGVSLLAILLSYFIAMHL
FGLNWQLQQTENDTFENGKVNSDTMPNTVSLPSGDNGKLGFTQENNTIDSGELDIGRR
AIQEIPPGIFWRSQFLIDQPQFLKFNISLQKDALIGVYGRKGLPPSHTQYDFVELLDGSR
LIAREQRSLLETERAGRQARSVSLHEAGFIQYLDSGIWHLAFYNDGKNAEQVSFNTIVIE
SVVECPRNCHGNCECVSGTCHCFPGFLGPDCSRACPVLCSGNGQYSKGRCLCFSGWKGT
ECDVPTTQCIDPQCGGRGICIMGSCACNSGYKGESCEEADCIDPGCSNHGVCIHGECHCS
PGWGGSNCEILKTMCPDQCSGHGTYLQESGSCCTDPNWTGPDCSNEICSVDCSGSHGVCMG
GTCRCCEGWTGPTCNQRACHPRCAEHGTCKDGKCECSHGWNGEHCTIEGCPGLCNSNGRC
TLDQNGWHCVCPQGWGAGCDVAMETLCTDSKDNEDGLIDCMDPDCCLOSSCQNPYCR
GLPDPQDIISQSLQSPSQAAKSFYDRISFLIGSDSTHVIPGESPFNKSLASVIRGQVLT
ADGTPLIGNVNSFFHYPEYGYTTITRQDGMFDLVANGGASLTLVFERSPFLTQYHTVWIPW
NVFYVMDTLVMEKEENDIPSCDLSGFVRPNPIIVSSPLSTFFRSPSPEDSPIIPETQVLHE
ETTIPGTDLKLSYLSRAAGYKSVLKITMTQSIIPFNLMKVHLMVAVVGRFLQKWFASP
NLAYTFIWDKTDAYNQKVYGLSEAVSVGYEYESCLDLTLWEKRTAILQGYELDASNMG
WTLDKHHVLDVQNGILYKNGENQFISQPPVVSSIMGNRRRSISCPSCNGQADGNKLL
APVALACGIDGSLYVGDFNYVRRIFPSGNVTSVLELRNKDFRHSSNPAHRYLATDPVTG
DLVSDTNTRRRIYRPKSLTGAKDLTKNAEVVAGTGEQCLPFDEARCGDGGKAVEATLMS
KGMVVDKNGLIYFVDGTMIRKVDQNGIISTLLGSNDLTSARPLTCDTSMHISQVRLEWPT
DLAINPMDNSIYVLDNNVVLQITENRQVRIAAGRPMHCQVPGVEYPVGKHAVQTTLESAT
AIAVSYSGLVLYITETDEKKINRIRQVTTDGEISLVAGIPSECDCKNDANDCYQSGDGYA
KDAKLSAPSSLAASPDGTLIADLGNIRIRAVSKNKPLLNSMNFYEVASPTDQELYIFDI
NGTHQYTVSLVTGDYLYNFSYSNDNDITAVTDSNGNTLRIRDPNRPVVRVSPDNQVIW
LTITNGCLKGMTAQGLELVLFTYHGNSSGLLATKSDETGWTTFDYDSEGRLTNVTFPTG
VVTNLHGDMDKAITVDIESSSREEDVSITSNLSSIDSFYTMVQDQLRNSYQIGYDGLRI
IYASGLDSHYQTEPHVLAGTANPTVAKRNMTPGENGQNLVEWRFRKEQAQGVNVFGRK
LRVNGRNLLSVDFDRTTKTEKIYDDHRKFLRLIAYDTSGHPTLWLPSSKLMVNVVTSST
GQIASIQRGTTSEKVDYDQGGRIVSRVFADGKTWSYTYLEKSMVLLLHSQRQYIFEYDMW
DRLSAITMPSVARHTMQTIRSIGYYRNIYNPPESNASIITDYNEEGLLLQTAFLGTSRRV
LFKYRRQTRLSEILYDSTRVSFTYDETAGVLKTVNLQSDGFICTIRYRQIGPLIDRQIFR
FSEGDGMVNARFDYSYDNSFRVTSMQGVINETPLPIDLYQFDDISGKVEQFGKFGVIYYDI
NQIISTAVMTYTKHFDAHGRIKEIQYEIFRSLMYWITIYQDNMGRVTKREIKIGPFANTT
KYAYEYDVGQLQTVYLNKIMWRYNYDLNGLHLLNPSNSARLTPRYDLRDRITRLGD
VQYRLDEDGFLRQRGTEIFEYSSKGLLTRVYSKSGSWTVIYRYDGLGRRVSSKTSLGQHL
QFFYADLTYPTRITHVYNHSSSEITSLYYDLQGHLEFAMEISSGDEFYIASDNTGTPLAVF
SSNGLMLKQIQYIYFDSNIDFQLVIGFHGGLYDPLTKLIHFGERDYDILAGRWT
PDIEIWKIRIGKDPAPFNLYMFRNNNPASKIHVDKYITDVNSWLVTFGFHLHNAIPGFPV
PKFDLTPESYELVKSQQWDDIPPIFGVQQQVARQAKAFLSLGKMAEVQVSRRRAGGAQSW
LWFATVKSLLIGKVMLAVSQGRVQTNVLNIANEDCIKVAAVLNNAFYLENLHFTIEGKDT
HYFIKTTTPESDLGTLRLTSGRKALENGINVTVSQSTTVVNGRTRRFADVEMQFGALALH
VRYGMTLDEEKARILEQARQALARAWAREQQVRDGEEGARLWTEGEKRQLLSAGKVQG
```

The full amino acid sequence of the protein of the invention was found to have 2496 of 2568 amino acid residues (97%) identical to, and 2527 of 2568 amino acid residues (98%) similar to, the 2715 amino acid residue ptnr:SPTREMBL-ACC:Q9WTS6 protein from Mus musculus (Mouse) (TEN-M3).

The TEN-M3-like gene disclosed in this invention is expressed in at least the following tissues: Adipose, Heart, Aorta, Coronary Artery, Parathyroid Gland, Pineal Gland, Colon, Spleen, Lymph node, Bone, Cartilage, Muscle, Smooth Muscle, Brain, Cerebellum, Right Cerebellum, Pituitary Gland, Temporal Lobe, Hippocampus, Cervix, Mammary gland/Breast, Ovary, Placenta, Uterus, Vulva, Prostate, Testis, Lung, Kidney, Retina, Skin, Dermis.

The nucleic acids and proteins of the invention have applications in the diagnosis and/or treatment of various diseases and disorders. For example, the compositions of the present invention will have efficacy for the treatment of patients suffering from: Cardiomyopathy, Atherosclerosis, Hypertension, Congenital heart defects, Aortic stenosis, Atrial septal defect (ASD), Atrioventricular (A-V) canal defect, Ductus arteriosus, Pulmonary stenosis, Subaortic stenosis, Ventricular septal defect (VSD), valve diseases, Tuberous sclerosis, Scleroderma, Obesity, Transplantation, Metabolic Disorders, Diabetes, Aneurysm, Fibromuscular dysplasia, Stroke, Myocardial infarction, Embolism, Cardiovascular disorders, Bypass surgery, Hyperparathyroidism, Hypoparathyroidism, Hyperthyroidism, Hypothyroidism, cancer, including but not limited to colon, lung, brain, leukemia, breast, ovarian, uterine, prostate, testicular, kidney and skin; SIDS, Lymphedema, Allergies, Osteoporosis, Hypercalcaemia, Arthritis, Ankylosing spondylitis, Scoliosis; Tendinitis; Muscular dystrophy, Lesch-Nyhan syndrome, Myasthenia gravis; Von Hippel-Lindau (VHL) syndrome, Alzheimer's disease, Stroke, Tuberous sclerosis, hypercalcaemia, Parkinson's disease, Huntington's disease, Cerebral palsy, Epilepsy, Lesch-Nyhan syndrome, Multiple sclerosis, Ataxia-telangiectasia, Leukodystrophies, Behavioral disorders, Addiction, Anxiety, Pain, Neuroprotection; Endocrine dysfunctions, Growth and reproductive disorders; Fertility; Endometriosis, Autoimmune disease, Asthma, Emphysema, Scleroderma, ARDS, Psoriasis, Actinic keratosis, Tuberous sclerosis, Acne, Hair growth, alopecia, pigmentation disorders, Renal artery stenosis, Interstitial nephritis, Glomerulonephritis, Polycystic kidney disease, Systemic lupus erythematosus, Renal tubular acidosis, IgA nephropathy, Hypercalcaemia, Lesch-Nyhan syndrome, CNS disorders, neuronal developmental disorders, heart diseases

such as stroke, myocardial infarction, ischemia, localized and systemic scleroderma, pleural inflammatory and fibrotic diseases as well as other diseases, disorders and conditions.

NOV15a, NOV15b, NOV15c, and NOV15d share a high degree of homology as is shown in the amino acid alignment in Table 15I.

Table 15I. Clustal W Alignment of NOV15a and NOV15b and NOV15c and NOV15d									
	10	20	30	40	50	60	70	80	
145665404	MDVKERRPYCSLT	KSRRKERRYTN	SSADNEECRVPT	QKSYSSSETLK	AFDHDSSRLLY	GNRVKDLVH	READEFTRC	QGN	
CG55069_02	MDVKERRPYCSLT	KSRRKERRYTN	SSADNEECRVPT	QKSYSSSETLK	AFDHDSSRLLY	GNRVKDLVH	READEFTRC	QGN	
CG55069_03	MDVKERRPYCSLT	KSRRKERRYTN	SSADNEECRVPT	QKSYSSSETLK	AFDHDSSRLLY	GNRVKDLVH	READEFTRC	---	
CG55069_08	MDVKERRPYCSLT	KSRRKERRYTN	SSADNEECRVPT	QKSYSSSETLK	AFDHDSSRLLY	GNRVKDLVH	READEFTRC	---	
	90	100	110	120	130	140	150	160	
145665404	FTLRQLGVCEPAT	RRGLAFCAEMGL	PHRGYSISAGS	DADTENEAVMS	PEHAMRLWGR	GVKSGRSSCL	SSRSNSALT	LTDT	
CG55069_02	FTLRQLGVCEPAT	RRGLAFCAEMGL	PHRGYSISAGS	DADTENEAVMS	PEHAMRLWGR	GVKSGRSSCL	SSRSNSALT	LTDT	
CG55069_03	FTLRQLGVCEPAT	RRGLAFCAEMGL	PHRGYSISAGS	DADTENEAVMS	PEHAMRLWGR	GVKSGRSSCL	SSRSNSALT	LTDT	
CG55069_08	FTLRQLGVCEPAT	RRGLAFCAEMGL	PHRGYSISAGS	DADTENEAVMS	PEHAMRLWGR	GVKSGRSSCL	SSRSNSALT	LTDT	
	170	180	190	200	210	220	230	240	
145665404	EHENKSDSEN	EQPASNQGQST	LQPLPPSHKQ	SAQHHPST	ITSLNRNSLT	NRRNQSPAP	PAALPAELQ	TTPE	
CG55069_02	EHENKSDSEN	EQPASNQGQST	LQPLPPSHKQ	SAQHHPST	ITSLNRNSLT	NRRNQSPAP	PAALPAELQ	TTPE	
CG55069_03	EHENKSDSEN	EQPASNQGQST	LQPLPPSHKQ	SAQHHPST	ITSLNRNSLT	NRRNQSPAP	PAALPAELQ	TTPE	
CG55069_08	EHENKSDSEN	EQPASNQGQST	LQPLPPSHKQ	SAQHHPST	ITSLNRNSLT	NRRNQSPAP	PAALPAELQ	TTPE	
	250	260	270	280	290	300	310	320	
145665404	LGSNVPLESRH	FLFKTGTGTT	PLFSTATPGY	TMASGSVYSP	PTPLPNTLSR	SFAFKFKSS	KYCSWKCTA	LCAVGVS	
CG55069_02	LGSNVPLESRH	FLFKTGTGTT	PLFSTATPGY	TMASGSVYSP	PTPLPNTLSR	SFAFKFKSS	KYCSWKCTA	LCAVGVS	
CG55069_03	LGSNVPLESRH	FLFKTGTGTT	PLFSTATPGY	TMASGSVYSP	PTPLPNTLSR	SFAFKFKSS	KYCSWKCTA	LCAVGVS	
CG55069_08	LGSNVPLESRH	FLFKTGTGTT	PLFSTATPGY	TMASGSVYSP	PTPLPNTLSR	SFAFKFKSS	KYCSWKCTA	LCAVGVS	
	330	340	350	360	370	380	390	400	
145665404	LAILLSYFIAM	HLFGLNWQLQ	QTENDTFENG	KVNSDTMPT	NTVSLPSGD	NGKLGFTQ	ENNTIDSG	ELDIGRAI	
CG55069_02	LAILLSYFIAM	HLFGLNWQLQ	QTENDTFENG	KVNSDTMPT	NTVSLPSGD	NGKLGFTQ	ENNTIDSG	ELDIGRAI	
CG55069_03	LAILLSYFIAM	HLFGLNWQLQ	QTENDTFENG	KVNSDTMPT	NTVSLPSGD	NGKLGFTQ	ENNTIDSG	ELDIGRAI	
CG55069_08	LAILLSYFIAM	HLFGLNWQLQ	QTENDTFENG	KVNSDTMPT	NTVSLPSGD	NGKLGFTQ	ENNTIDSG	ELDIGRAI	
	410	420	430	440	450	460	470	480	
145665404	GIFWRSQFL	IDQPQFLKFN	ISLQKDALI	GVYGRKGL	PPSHTQSSP	QYDFVELLD	GSRLIARE	QRSLLTER	
CG55069_02	GIFWRSQFL	IDQPQFLKFN	ISLQKDALI	GVYGRKGL	PPSHTQSSP	QYDFVELLD	GSRLIARE	QRSLLTER	
CG55069_03	GIFWRSQFL	IDQPQFLKFN	ISLQKDALI	GVYGRKGL	PPSHTQSSP	QYDFVELLD	GSRLIARE	QRSLLTER	
CG55069_08	GIFWRSQFL	IDQPQFLKFN	ISLQKDALI	GVYGRKGL	PPSHTQSSP	QYDFVELLD	GSRLIARE	QRSLLTER	
	490	500	510	520	530	540	550	560	
145665404	LHEAGFIQYLD	SGIWHLAFY	NDGKNABQ	VSFNTIVIES	VVECPRNCH	GNCECVSGT	CHCFPGFL	GPDCSRA	
CG55069_02	LHEAGFIQYLD	SGIWHLAFY	NDGKNABQ	VSFNTIVIES	VVECPRNCH	GNCECVSGT	CHCFPGFL	GPDCSRA	
CG55069_03	LHEAGFIQYLD	SGIWHLAFY	NDGKNABQ	VSFNTIVIES	VVECPRNCH	GNCECVSGT	CHCFPGFL	GPDCSRA	
CG55069_08	LHEAGFIQYLD	SGIWHLAFY	NDGKNABQ	VSFNTIVIES	VVECPRNCH	GNCECVSGT	CHCFPGFL	GPDCSRA	
	570	580	590	600	610	620	630	640	
145665404	GQYSKGRCL	CFSGWKTECD	VPTTQCIDP	QCGGRGIC	IMGSCACSS	GGYKGESCE	EADCIDPG	CNSNHGVC	
CG55069_02	GQYSKGRCL	CFSGWKTECD	VPTTQCIDP	QCGGRGIC	IMGSCACSS	GGYKGESCE	EADCIDPG	CNSNHGVC	
CG55069_03	GQYSKGRCL	CFSGWKTECD	VPTTQCIDP	QCGGRGIC	IMGSCACSS	GGYKGESCE	EADCIDPG	CNSNHGVC	
CG55069_08	GQYSKGRCL	CFSGWKTECD	VPTTQCIDP	QCGGRGIC	IMGSCACSS	GGYKGESCE	EADCIDPG	CNSNHGVC	
	650	660	670	680	690	700	710	720	
145665404	GGSNCEILK	TMCPCDQCS	GHGTYLQES	GSCTCDPN	WTGPDCSNE	ICSVDCGSH	GVCMGGT	CRCEBGW	
CG55069_02	GGSNCEILK	TMCPCDQCS	GHGTYLQES	GSCTCDPN	WTGPDCSNE	ICSVDCGSH	GVCMGGT	CRCEBGW	
CG55069_03	GGSNCEILK	TMCPCDQCS	GHGTYLQES	GSCTCDPN	WTGPDCSNE	ICSVDCGSH	GVCMGGT	CRCEBGW	
CG55069_08	GGSNCEILK	TMCPCDQCS	GHGTYLQES	GSCTCDPN	WTGPDCSNE	ICSVDCGSH	GVCMGGT	CRCEBGW	
	730	740	750	760	770	780	790	800	
145665404	AEHGTCKD	GKCECSQ	QWNGEHCT	IAHYLDK	IVKDKIGY	KEGCPGL	CNSNGR	CTLDQNG	
CG55069_02	AEHGTCKD	GKCECSQ	QWNGEHCT	IAHYLDK	IVKDKIGY	KEGCPGL	CNSNGR	CTLDQNG	
CG55069_03	AEHGTCKD	GKCECSQ	QWNGEHCT	IAHYLDK	IVKDKIGY	KEGCPGL	CNSNGR	CTLDQNG	
CG55069_08	AEHGTCKD	GKCECSQ	QWNGEHCT	IAHYLDK	IVKDKIGY	KEGCPGL	CNSNGR	CTLDQNG	
	810	820	830	840	850	860	870	880	
145665404	TDSKDNB	GGDLIDC	MDPDCC	LQSSCQ	QNPYCR	GLPDPQ	DIISQ	LSQSP	
CG55069_02	TDSKDNB	GGDLIDC	MDPDCC	LQSSCQ	QNPYCR	GLPDPQ	DIISQ	LSQSP	
CG55069_03	TDSKDNB	GGDLIDC	MDPDCC	LQSSCQ	QNPYCR	GLPDPQ	DIISQ	LSQSP	
CG55069_08	TDSKDNB	GGDLIDC	MDPDCC	LQSSCQ	QNPYCR	GLPDPQ	DIISQ	LSQSP	

CG55069\_08 TDSKDNEDGLIDCMDPCCLQSSCQNPYCRGLPDPQDIISQSLQSPSQQAASFYDRISFLIGSDSTHVIPGESPFNF

890 900 910 920 930 940 950 960

145665404 SLASVIRGQVLTADGTPILGVNVSFFHYPEYGYTTITRODGMFDLVANGGASLTIVFERSPFLTQYHTVNIIPWNVFYVMDT

CG55069\_02 SLASVIRGQVLTADGTPILGVNVSFFHYPEYGYTTITRODGMFDLVANGGASLTIVFERSPFLTQYHTVNIIPWNVFYVMDT

CG55069\_03 SLASVIRGQVLTADGTPILGVNVSFFHYPEYGYTTITRODGMFDLVANGGASLTIVFERSPFLTQYHTVNIIPWNVFYVMDT

CG55069\_08 SLASVIRGQVLTADGTPILGVNVSFFHYPEYGYTTITRODGMFDLVANGGASLTIVFERSPFLTQYHTVNIIPWNVFYVMDT

970 980 990 1000 1010 1020 1030 1040

145665404 LVMEKEENDIPSCDLSGFVRNPPIIVSSPLSTFFRSPSPEDSPIIPETQVLHEETTPGTDLKLSYLSSRAAGYKSVLKIT

CG55069\_02 LVMEKEENDIPSCDLSGFVRNPPIIVSSPLSTFFRSPSPEDSPIIPETQVLHEETTPGTDLKLSYLSSRAAGYKSVLKIT

CG55069\_03 LVMEKEENDIPSCDLSGFVRNPPIIVSSPLSTFFRSPSPEDSPIIPETQVLHEETTPGTDLKLSYLSSRAAGYKSVLKIT

CG55069\_08 LVMEKEENDIPSCDLSGFVRNPPIIVSSPLSTFFRSPSPEDSPIIPETQVLHEETTPGTDLKLSYLSSRAAGYKSVLKIT

1050 1060 1070 1080 1090 1100 1110 1120

145665404 MTQSIIPFNLKMKVHLMVAVVGRLPQKWFPAENLAYTFIWDKTDAYNQKVYGLSEAVVSVGYEYESCLDLTLWEKRTAIL

CG55069\_02 MTQSIIPFNLKMKVHLMVAVVGRLPQKWFPAENLAYTFIWDKTDAYNQKVYGLSEAVVSVGYEYESCLDLTLWEKRTAIL

CG55069\_03 MTQSIIPFNLKMKVHLMVAVVGRLPQKWFPAENLAYTFIWDKTDAYNQKVYGLSEAVVSVGYEYESCLDLTLWEKRTAIL

CG55069\_08 MTQSIIPFNLKMKVHLMVAVVGRLPQKWFPAENLAYTFIWDKTDAYNQKVYGLSEAVVSVGYEYESCLDLTLWEKRTAIL

1130 1140 1150 1160 1170 1180 1190 1200

145665404 QGYELDASNMGWTLDKHHVLDVQNGILYKNGENQFISQQPPVSSIMGNRRRSISCPSCNGQADGNKLLAPVALACG

CG55069\_02 QGYELDASNMGWTLDKHHVLDVQNGILYKNGENQFISQQPPVSSIMGNRRRSISCPSCNGQADGNKLLAPVALACG

CG55069\_03 QGYELDASNMGWTLDKHHVLDVQNGILYKNGENQFISQQPPVSSIMGNRRRSISCPSCNGQADGNKLLAPVALACG

CG55069\_08 QGYELDASNMGWTLDKHHVLDVQNGILYKNGENQFISQQPPVSSIMGNRRRSISCPSCNGQADGNKLLAPVALACG

1210 1220 1230 1240 1250 1260 1270 1280

145665404 IDGSLYVGDPNYVRRIFPPSGNVTSLVLELRNKDFRHSNPAHRYLATDPVTGDLVSDNTNRIYRPKSLTGAKDLTKNA

CG55069\_02 IDGSLYVGDPNYVRRIFPPSGNVTSLVLELRNKDFRHSNPAHRYLATDPVTGDLVSDNTNRIYRPKSLTGAKDLTKNA

CG55069\_03 IDGSLYVGDPNYVRRIFPPSGNVTSLVLELRNKDFRHSNPAHRYLATDPVTGDLVSDNTNRIYRPKSLTGAKDLTKNA

CG55069\_08 IDGSLYVGDPNYVRRIFPPSGNVTSLVLELRNKDFRHSNPAHRYLATDPVTGDLVSDNTNRIYRPKSLTGAKDLTKNA

1290 1300 1310 1320 1330 1340 1350 1360

145665404 EVVAGTGEQCLPFDEARCGDGGKAVEATLMSPKGMAVDKNGLIYFVDGTMIRKVDQNGIISTLLGSNDLTSARPLTCDTS

CG55069\_02 EVVAGTGEQCLPFDEARCGDGGKAVEATLMSPKGMAVDKNGLIYFVDGTMIRKVDQNGIISTLLGSNDLTSARPLTCDTS

CG55069\_03 EVVAGTGEQCLPFDEARCGDGGKAVEATLMSPKGMAVDKNGLIYFVDGTMIRKVDQNGIISTLLGSNDLTSARPLTCDTS

CG55069\_08 EVVAGTGEQCLPFDEARCGDGGKAVEATLMSPKGMAVDKNGLIYFVDGTMIRKVDQNGIISTLLGSNDLTSARPLTCDTS

1370 1380 1390 1400 1410 1420 1430 1440

145665404 MHISOVRLEWPTDLAINPMDNSIYVLDDNNVVLQITENROVRIAAGRPMHCQVPGVEYVPGKHAVOTTLESATAIAVSYSG

CG55069\_02 MHISOVRLEWPTDLAINPMDNSIYVLDDNNVVLQITENROVRIAAGRPMHCQVPGVEYVPGKHAVOTTLESATAIAVSYSG

CG55069\_03 MHISOVRLEWPTDLAINPMDNSIYVLDDNNVVLQITENROVRIAAGRPMHCQVPGVEYVPGKHAVOTTLESATAIAVSYSG

CG55069\_08 MHISOVRLEWPTDLAINPMDNSIYVLDDNNVVLQITENROVRIAAGRPMHCQVPGVEYVPGKHAVOTTLESATAIAVSYSG

1450 1460 1470 1480 1490 1500 1510 1520

145665404 VLYITETDEKKINRIRQVTTDGEISLVAGIPSECDCKNDANCDQYQSGDGYAKDAKLSAPSSLAASPDGTLTYIADLGNIR

CG55069\_02 VLYITETDEKKINRIRQVTTDGEISLVAGIPSECDCKNDANCDQYQSGDGYAKDAKLSAPSSLAASPDGTLTYIADLGNIR

CG55069\_03 VLYITETDEKKINRIRQVTTDGEISLVAGIPSECDCKNDANCDQYQSGDGYAKDAKLSAPSSLAASPDGTLTYIADLGNIR

CG55069\_08 VLYITETDEKKINRIRQVTTDGEISLVAGIPSECDCKNDANCDQYQSGDGYAKDAKLSAPSSLAASPDGTLTYIADLGNIR

1530 1540 1550 1560 1570 1580 1590 1600

145665404 IRAVSKNKPPLNSMNFYEASPTDQELYPIDINGTHQYTVSLVTGDLVNFYSYNDNDITAVTDSNGNTLRIRRDPNRME

CG55069\_02 IRAVSKNKPPLNSMNFYEASPTDQELYPIDINGTHQYTVSLVTGDLVNFYSYNDNDITAVTDSNGNTLRIRRDPNRME

CG55069\_03 IRAVSKNKPPLNSMNFYEASPTDQELYPIDINGTHQYTVSLVTGDLVNFYSYNDNDITAVTDSNGNTLRIRRDPNRME

CG55069\_08 IRAVSKNKPPLNSMNFYEASPTDQELYPIDINGTHQYTVSLVTGDLVNFYSYNDNDITAVTDSNGNTLRIRRDPNRME

1610 1620 1630 1640 1650 1660 1670 1680

145665404 VRVVSPPDNQVWLTIGTNGCLKGMTAQQGLELVLFYHGNISGLLATKSDETGWTTFFDYDSEGRLTNVTFPTGVVTVNLHGD

CG55069\_02 VRVVSPPDNQVWLTIGTNGCLKGMTAQQGLELVLFYHGNISGLLATKSDETGWTTFFDYDSEGRLTNVTFPTGVVTVNLHGD

CG55069\_03 VRVVSPPDNQVWLTIGTNGCLKGMTAQQGLELVLFYHGNISGLLATKSDETGWTTFFDYDSEGRLTNVTFPTGVVTVNLHGD

CG55069\_08 VRVVSPPDNQVWLTIGTNGCLKGMTAQQGLELVLFYHGNISGLLATKSDETGWTTFFDYDSEGRLTNVTFPTGVVTVNLHGD

1690 1700 1710 1720 1730 1740 1750 1760

145665404 MDKAITVDIESSSREEDVSITSNLSSIDSFYTMVQDQLRNSYQIGYDGLSLRIIYASGLDSHYQTEPHVLAGTANPTVAKR

CG55069\_02 MDKAITVDIESSSREEDVSITSNLSSIDSFYTMVQDQLRNSYQIGYDGLSLRIIYASGLDSHYQTEPHVLAGTANPTVAKR

CG55069\_03 MDKAITVDIESSSREEDVSITSNLSSIDSFYTMVQDQLRNSYQIGYDGLSLRIIYASGLDSHYQTEPHVLAGTANPTVAKR

CG55069\_08 MDKAITVDIESSSREEDVSITSNLSSIDSFYTMVQDQLRNSYQIGYDGLSLRIIYASGLDSHYQTEPHVLAGTANPTVAKR

1770 1780 1790 1800 1810 1820 1830 1840

145665404 NMTLPGENGQNLVLEWRFRKEQAQGVNVFGRKLRVNGRNLLSVDFDRTTKTEKIYDDHRKFLLRIAYDTSQHPPTLWLPSS

CG55069\_02 NMTLPGENGQNLVLEWRFRKEQAQGVNVFGRKLRVNGRNLLSVDFDRTTKTEKIYDDHRKFLLRIAYDTSQHPPTLWLPSS

CG55069\_03 NMTLPGENGQNLVLEWRFRKEQAQGVNVFGRKLRVNGRNLLSVDFDRTTKTEKIYDDHRKFLLRIAYDTSQHPPTLWLPSS

CG55069\_08 NMTLPGENGQNLVLEWRFRKEQAQGVNVFGRKLRVNGRNLLSVDFDRTTKTEKIYDDHRKFLLRIAYDTSQHPPTLWLPSS

1850 1860 1870 1880 1890 1900 1910 1920

145665404 KLMVAVNTYSSSTGQIASIQRTTSERVDYDGGGRIVSRVADGKTWSYTYLEKSMVLLLSQRYIFEDMMDRLSAITM

CG55069_02	KLMAVNVTYSSTGQIASIQRTTSEKVDYDGGQRIVSRVFADGKTWSYTYLEKSMVLLHLSQRQYIFEYDMWDRLSATTM
CG55069_03	KLMAVNVTYSSTGQIASIQRTTSEKVDYDGGQRIVSRVFADGKTWSYTYLEKSMVLLHLSQRQYIFEYDMWDRLSATTM
CG55069_08	KLMAVNVTYSSTGQIASIQRTTSEKVDYDGGQRIVSRVFADGKTWSYTYLEKSMVLLHLSQRQYIFEYDMWDRLSATTM
	1930 1940 1950 1960 1970 1980 1990 2000
145665404	PSVARHTMQTIRSIGYYRNIYNPPESNASIITDYNBEGLLQLTAFGLTSRRVLFKYRRQTRLSEILDSTRVSFTYDETA
CG55069_02	PSVARHTMQTIRSIGYYRNIYNPPESNASIITDYNBEGLLQLTAFGLTSRRVLFKYRRQTRLSEILDSTRVSFTYDETA
CG55069_03	PSVARHTMQTIRSIGYYRNIYNPPESNASIITDYNBEGLLQLTAFGLTSRRVLFKYRRQTRLSEILDSTRVSFTYDETA
CG55069_08	PSVARHTMQTIRSIGYYRNIYNPPESNASIITDYNBEGLLQLTAFGLTSRRVLFKYRRQTRLSEILDSTRVSFTYDETA
	2010 2020 2030 2040 2050 2060 2070 2080
145665404	GVLKTVNLQSDGFICTIRYRQIGPLIDRQIFRFSSEDMVNARFDYSYDNSFRVTSMQGVINETPLPIDLYQFDDISGKVE
CG55069_02	GVLKTVNLQSDGFICTIRYRQIGPLIDRQIFRFSSEDMVNARFDYSYDNSFRVTSMQGVINETPLPIDLYQFDDISGKVE
CG55069_03	GVLKTVNLQSDGFICTIRYRQIGPLIDRQIFRFSSEDMVNARFDYSYDNSFRVTSMQGVINETPLPIDLYQFDDISGKVE
CG55069_08	GVLKTVNLQSDGFICTIRYRQIGPLIDRQIFRFSSEDMVNARFDYSYDNSFRVTSMQGVINETPLPIDLYQFDDISGKVE
	2090 2100 2110 2120 2130 2140 2150 2160
145665404	QFGKFGVIYYDINQIISTAVMTYTKHFDAGHRIKEIQYEIFRSLMYWITIYQDNMGRVTKREIKIGPFANTTKYAYEYDV
CG55069_02	QFGKFGVIYYDINQIISTAVMTYTKHFDAGHRIKEIQYEIFRSLMYWITIYQDNMGRVTKREIKIGPFANTTKYAYEYDV
CG55069_03	QFGKFGVIYYDINQIISTAVMTYTKHFDAGHRIKEIQYEIFRSLMYWITIYQDNMGRVTKREIKIGPFANTTKYAYEYDV
CG55069_08	QFGKFGVIYYDINQIISTAVMTYTKHFDAGHRIKEIQYEIFRSLMYWITIYQDNMGRVTKREIKIGPFANTTKYAYEYDV
	2170 2180 2190 2200 2210 2220 2230 2240
145665404	DGQLOTVVLNEKIMWRNYDNLGNLHLLNPSNSARLTPLRYDLDRITRLGDVQYRLDEDDGFLRQGTETFEYSSKGLLT
CG55069_02	DGQLOTVVLNEKIMWRNYDNLGNLHLLNPSNSARLTPLRYDLDRITRLGDVQYRLDEDDGFLRQGTETFEYSSKGLLT
CG55069_03	DGQLOTVVLNEKIMWRNYDNLGNLHLLNPSNSARLTPLRYDLDRITRLGDVQYRLDEDDGFLRQGTETFEYSSKGLLT
CG55069_08	DGQLOTVVLNEKIMWRNYDNLGNLHLLNPSNSARLTPLRYDLDRITRLGDVQYRLDEDDGFLRQGTETFEYSSKGLLT
	2250 2260 2270 2280 2290 2300 2310 2320
145665404	RVYSKSGSWTVIYRYDGLGRRVSSKTSLGQHLQFFYADLTYPTRITHVYNHSSSEITSLYYDLQGHLFAMEISSGDEFYI
CG55069_02	RVYSKSGSWTVIYRYDGLGRRVSSKTSLGQHLQFFYADLTYPTRITHVYNHSSSEITSLYYDLQGHLFAMEISSGDEFYI
CG55069_03	RVYSKSGSWTVIYRYDGLGRRVSSKTSLGQHLQFFYADLTYPTRITHVYNHSSSEITSLYYDLQGHLFAMEISSGDEFYI
CG55069_08	RVYSKSGSWTVIYRYDGLGRRVSSKTSLGQHLQFFYADLTYPTRITHVYNHSSSEITSLYYDLQGHLFAMEISSGDEFYI
	2330 2340 2350 2360 2370 2380 2390 2400
145665404	ASDNTGTPLAVFSSNGLMLKQIQYTAYGEIYFDSNIDFQLVIGFHGGLYDPLTKLIHFGERDYDILAGRWTTPDIEIWKRR
CG55069_02	ASDNTGTPLAVFSSNGLMLKQIQYTAYGEIYFDSNIDFQLVIGFHGGLYDPLTKLIHFGERDYDILAGRWTTPDIEIWKRR
CG55069_03	ASDNTGTPLAVFSSNGLMLKQIQYTAYGEIYFDSNIDFQLVIGFHGGLYDPLTKLIHFGERDYDILAGRWTTPDIEIWKRR
CG55069_08	ASDNTGTPLAVFSSNGLMLKQIQYTAYGEIYFDSNIDFQLVIGFHGGLYDPLTKLIHFGERDYDILAGRWTTPDIEIWKRR
	2410 2420 2430 2440 2450 2460 2470 2480
145665404	IGKDPAPFNLYMFRNNNPASKIHVDKDYITDVNSWLVTFGFHLHNAIPGFVPVKFDLTPSYELVKSQWDDIPPIFGVC
CG55069_02	IGKDPAPFNLYMFRNNNPASKIHVDKDYITDVNSWLVTFGFHLHNAIPGFVPVKFDLTPSYELVKSQWDDIPPIFGVC
CG55069_03	IGKDPAPFNLYMFRNNNPASKIHVDKDYITDVNSWLVTFGFHLHNAIPGFVPVKFDLTPSYELVKSQWDDIPPIFGVC
CG55069_08	IGKDPAPFNLYMFRNNNPASKIHVDKDYITDVNSWLVTFGFHLHNAIPGFVPVKFDLTPSYELVKSQWDDIPPIFGVC
	2490 2500 2510 2520 2530 2540 2550 2560
145665404	QQVARQAKAFLSLGKMAEVQVSRRRAGGAQSWLWFATVKSLIGKGVMLAVSQGRVQTNVLNIANEDCIKVAAVLNNAFYL
CG55069_02	QQVARQAKAFLSLGKMAEVQVSRRRAGGAQSWLWFATVKSLIGKGVMLAVSQGRVQTNVLNIANEDCIKVAAVLNNAFYL
CG55069_03	QQVARQAKAFLSLGKMAEVQVSRRRAGGAQSWLWFATVKSLIGKGVMLAVSQGRVQTNVLNIANEDCIKVAAVLNNAFYL
CG55069_08	QQVARQAKAFLSLGKMAEVQVSRRRAGGAQSWLWFATVKSLIGKGVMLAVSQGRVQTNVLNIANEDCIKVAAVLNNAFYL
	2570 2580 2590 2600 2610 2620 2630 2640
145665404	ENLHFTIEGKDTHYFIKTTTPESDLGLRLTSGRKALENGINVTVSQSTTVVNGRTRRFADVEMQFALALHVRVYGMTLD
CG55069_02	ENLHFTIEGKDTHYFIKTTTPESDLGLRLTSGRKALENGINVTVSQSTTVVNGRTRRFADVEMQFALALHVRVYGMTLD
CG55069_03	ENLHFTIEGKDTHYFIKTTTPESDLGLRLTSGRKALENGINVTVSQSTTVVNGRTRRFADVEMQFALALHVRVYGMTLD
CG55069_08	ENLHFTIEGKDTHYFIKTTTPESDLGLRLTSGRKALENGINVTVSQSTTVVNGRTRRFADVEMQFALALHVRVYGMTLD
	2650 2660 2670 2680 2690 2700 2710 2720
145665404	BEKARILEQARQALARAWAREQQQRVRDGEGARLWTEGEXRQLLSAGKVQGYDGYVYLSVEQYPELADSANNIQFLRQS
CG55069_02	BEKARILEQARQALARAWAREQQQRVRDGEGARLWTEGEXRQLLSAGKVQGYDGYVYLSVEQYPELADSANNIQFLRQS
CG55069_03	BEKARILEQARQALARAWAREQQQRVRDGEGARLWTEGEXRQLLSAGKVQGYDGYVYLSVEQYPELADSANNIQFLRQS
CG55069_08	BEKARILEQARQALARAWAREQQQRVRDGEGARLWTEGEXRQLLSAGKVQGYDGYVYLSVEQYPELADSANNIQFLRQS
	....
145665404	EIGRR
CG55069_02	EIGRR
CG55069_03	EIGRR
CG55069_08	EIGRR

In a search of public sequence databases, NOV15a was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 15J.

**Table 15J. BLASTP results for NOV15a**

Gene Index/ Identifier	Protein/Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SPTREMBL- ACC:Q9WTS6	TEN-M3 - Mus musculus	2715	2663/2725 (97%)	2696/2725 (98%)	0.0
ptnr:SPTREMBL- ACC:Q9W7R4	TEN-M3 - Brachydanio rerio (Zebrafish) (Zebra danio)	2590	2004/2579 (77%)	2255/2579 (87%)	0.0
ptnr:SPTREMBL- ACC:Q9JLC1	ODZ3 - Mus musculus	2346	2015/2182 (92%)	2053/2182 (94%)	0.0
ptnr:SPTREMBL- ACC:Q9WTS7	TEN-M4 - Mus musculus	2771	1752/2637 (66%)	2098/2637 (79%)	0.0
ptnr:SPTREMBL- ACC:Q9P273	KIAA1455 PROTEIN - Homo sapiens	1769	1767/1769 (99%)	1768/1769 (99%)	0.0

Other BLAST results include sequences from the Patp database, which is a proprietary database that contains sequences published in patents and patent publications. Patp results include those listed in Table 15K.

**Table 15K. Patp BLASTP Analysis for NOV15a**

Sequences producing High-scoring Segment Pairs	Protein/Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAM78695	Human protein SEQ ID NO 1357 - Homo sapiens	2136	1255/2137 (58%)	1625/2137 (76%)	0.0
patp:AAB92858	Human protein sequence SEQ ID NO:11431 - Homo sapiens	1045	1045/1045 (100%)	1045/1045 (100%)	0.0
patp:AAB93294	Human protein sequence SEQ ID NO:12355 - Homo sapiens	964	964/964 (100%)	964/964 (100%)	0.0
patp:AAB92780	Human protein sequence SEQ ID NO:11266 - Homo sapiens	625	625/625 (100%)	625/625 (100%)	0.0
patp:AAM79679	Human protein SEQ ID NO 3325 - Homo sapiens	1015	569/1009 (56%)	741/1009 (73%)	2.6e-308

5

Table 15L lists the domain description from DOMAIN analysis results against NOV15a.

**Table 15L. Domain Analysis of NOV15a**

Pfam analysis									
Model	Domain	seq-f	seq-t	hmm-f	hmm-t	score	E-value		
EGF	1/7	522	548 ..	1	45 []	12.8	1.6		
EGF	2/7	586	613 ..	1	45 []	16.5	0.63		
EGF	3/7	618	645 ..	1	45 []	19.3	0.093		
TIL	1/1	604	652 ..	1	67 []	-15.5	9.9		
EGF	4/7	652	680 ..	1	45 []	13.3	1.4		
EGF	5/7	685	711 ..	1	45 []	12.2	1.8		
EGF	6/7	716	742 ..	1	45 []	21.3	0.023		
EGF	7/7	762	792 ..	1	45 []	14.5	1.1		

ATHILA	1/1	1217	1234 ..	355	372 ..	3.2	2.1
NHL	1/2	1368	1395 ..	1	30 []	9.8	1.7
NHL	2/2	1497	1524 ..	1	30 []	10.5	1.3
Glyco_hydro_38	1/1	1845	1870 ..	688	715 .]	4.3	1.3

Alignments of top-scoring domains:

EGF: domain 1 of 7, from 522 to 548: score 12.8, E = 1.6

(SEQ ID NO:182)	CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC-
	+ + +++ + ++   +     + ++
NOV15a 522	CPR--NCHGNGEVCVSG-----TCHCFPG-----FLGPDC 548

EGF: domain 2 of 7, from 586 to 613: score 16.5, E = 0.63

(SEQ ID NO:183)	CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC-
	++   ++ +  + + +           +  +
NOV15a 586	CIDP-QCGRGICIMG-----SCACSSG-----YKGESC 613

EGF: domain 3 of 7, from 618 to 645: score 19.3, E = 0.093

(SEQ ID NO:184)	CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC-
	++ + + + +  + + +   +      +  +
NOV15a 618	CIDP-GCSNHGVCIHG-----ECHCSPG-----WGGSN 645

TIL: domain 1 of 1, from 604 to 652: score -15.5, E = 9.9

(SEQ ID NO:185)	CpaneqyteCgpsCepsCsnpdgplettppCegtSpkVPstCkeg.C
	+   +   +   +   +   +   +   +   +
NOV15a 604	CSSGYKGESCE---EADCIDPG-----CS-----NHGVCIHGeC 634
	vCqpGyVrnnldgdkCVprseC<*
	+     +   + + + +
635	HCSPGWGGSNCE---ILKTMC 652

EGF: domain 4 of 7, from 652 to 680: score 13.3, E = 1.4

(SEQ ID NO:186)	CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC-
	++   ++  +   +   +   +   +   +
NOV15a 652	CPD--QCSGHGTYLQESG-----SCTCDPN-----WTGPDC 680

EGF: domain 5 of 7, from 685 to 711: score 12.2, E = 1.8

(SEQ ID NO:187)	CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC-
	+   + + + +   +  +  + +
NOV15a 685	CSV--DCGSHGVCMGG-----TCRCEEG-----WTGPAC 711

EGF: domain 6 of 7, from 716 to 742: score 21.3, E = 0.023

(SEQ ID NO:188)	CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC-
	+   + +  + + +   +  +  + +
NOV15a 716	CHP--RCAEHGTCKDG-----KCECSQG-----WNGEHC 742

EGF: domain 7 of 7, from 762 to 792: score 14.5, E = 1.1

(SEQ ID NO:189)	CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC-
	+   + + +  + + +   + +  +  +
NOV15a 762	CPG--LCNSNGRCTLDQN-----GGHCVCQPG-----WRGAGC 792

ATHILA: domain 1 of 1, from 1217 to 1234: score 3.2, E = 2.1

(SEQ ID NO:190)	LPceevTsIierdnIdFk<*
	+ + + + ++  + + +
NOV15a 1217	FPSGNVTSVLELRNKDFR 1234

NHL: domain 1 of 2, from 1368 to 1395: score 9.8, E = 1.7

(SEQ ID NO:191)	fdrPrGvavdpsdGqivVaDqsenhriqvF<*
	+ + +++ ++  +  +  +  +  +
NOV15a 1368	LEWPTDLAINPMDNSIYVLD--NNVVLQIT 1395

NHL: domain 2 of 2, from 1497 to 1524: score 10.5, E = 1.3

(SEQ ID NO:192)	fdrPrGvavdpsdGqivVaDqsenhriqvF<*
-----------------	----------------------------------



NOV15a	1497	+   ++ + +   +++   +	1524
LSAPSSLAAS-PDGTLYIAD-LGNIRIRAV			
Glyco_hydro_38: domain 1 of 1, from 1845 to 1870: score 4.3, E = 1.3			
(SEQ ID NO:193) lkveFdeletGllksitrkqdnktvhvn<-*			
++  ++    ++  +  ++ + +++			
NOV15a	1845	VNVITYS--STGQIASIQRGTTSEKVDYD	1870

In a search of public sequence databases, NOV15d was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 15M.

Table 15M. BLASTP results for NOV15d					
Gene Index/ Identifier	Protein/Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SPTREMBL- ACC:Q9WTS6	TEN-M3 - Mus musculus	2715	2496/2568 (97%)	2527/2568 (98%)	0.0
ptnr:SPTREMBL- ACC:Q9JLC1	ODZ3 - Mus musculus	2346	2309/2353 (98%)	2334/2353 (99%)	0.0
ptnr:SPTREMBL- ACC:Q9W7R4	TEN-M3 - Brachydanio rerio (Zebrafish) (Zebra danio)	2590	2117/2576 (82%)	2352/2576 (91%)	0.0
ptnr:SPTREMBL- ACC:Q9R1K2	NEURESTIN ALPHA - Rattus norvegicus	2765	1783/2534 (70%)	2135/2534 (84%)	0.0
ptnr:SPTREMBL- ACC:Q9DER5	TENEURIN-2 - Gallus gallus	2802	1779/2536 (70%)	2143/2536 (84%)	0.0

- 5 Other BLAST results include sequences from the Patp database, which is a proprietary database that contains sequences published in patents and patent publications. Patp results include those listed in Table 15N.

Table 15N. Patp BLASTP Analysis for NOV15					
Sequences producing High- scoring Segment Pairs	Protein/Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAM78695	Human protein SEQ ID NO 1357 - Homo sapiens	2136	1185/1962 (60%)	1521/1962 (77%)	0.0
patp:AAB92858	Human protein sequence SEQ ID NO:11431 - Homo sapiens	1045	1045/1045 (100%)	1045/1045 (100%)	0.0
patp:AAB93294	Human protein sequence SEQ ID NO:12355 - Homo sapiens	964	964/964 (100%)	964/964 (100%)	0.0
patp:AAB92780	Human protein sequence SEQ ID NO:11266 - Homo sapiens	625	625/625 (100%)	625/625 (100%)	0.0
patp:AAM79679	Human protein SEQ ID NO 3325 - Homo sapiens	1015	569/1009 (56%)	741/1009 (73%)	2.6e-308

- 10 Table 15O lists the domain description from DOMAIN analysis results against NOV15d.

Table 150. Domain Analysis of NOV15d

Pfam analysis								
Model	Domain	seq-f	seq-t	hmm-f	hmm-t	score	E-value	
-----	-----	-----	-----	-----	-----	-----	-----	
EGF	1/7	425	451 ..	1	45 []	12.8	1.6	
EGF	2/7	489	516 ..	1	45 []	14.8	1	
EGF	3/7	521	548 ..	1	45 []	19.3	0.093	
EGF	4/7	555	583 ..	1	45 []	13.3	1.4	
EGF	5/7	588	614 ..	1	45 []	14.1	1.2	
EGF	6/7	619	645 ..	1	45 []	21.0	0.027	
EGF	7/7	650	680 ..	1	45 []	17.2	0.38	
ATHILA	1/1	1105	1122 ..	355	372 ..	3.2	2.1	
NHL	1/2	1256	1283 ..	1	30 []	9.8	1.7	
NHL	2/2	1385	1412 ..	1	30 []	10.5	1.3	
Glyco_hydro_38	1/1	1733	1758 ..	688	715 .]	4.3	1.3	
Alignments of top-scoring domains:								
EGF: domain 1 of 7, from 425 to 451: score 12.8, E = 1.6								
(SEQ ID NO:196)			CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC<-					
			+   + +++ + ++     +      +   ++					
NOV15d	425		CPR--NCHGNCECVSG-----TCHCFPG-----FLGPDC					451
EGF: domain 2 of 7, from 489 to 516: score 14.8, E = 1								
(SEQ ID NO:197)			CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC<-					
			++   ++ + + + +           +					
NOV15d	489		CIDP-QCGRGICIMG-----SCACNSG-----YKGESC					516
EGF: domain 3 of 7, from 521 to 548: score 19.3, E = 0.093								
(SEQ ID NO:198)			CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC<-					
			++ +      +  + + + +   +      +   +					
NOV15d	521		CIDP-GCSNHGVCIHG-----ECHCSPG-----WGSNC					548
EGF: domain 4 of 7, from 555 to 583: score 13.3, E = 1.4								
(SEQ ID NO:199)			CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC<-					
			++     ++    +   +   +   +   +  +  +					
NOV15d	555		CPD--QCSGHGTYLQESG-----SCTCDPN-----WTGPDC					583
EGF: domain 5 of 7, from 588 to 614: score 14.1, E = 1.2								
(SEQ ID NO:200)			CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC<-					
			+   +  +  +  + +     +  +  +  +  +					
NOV15d	588		CSV--DCGSHGVCMGG-----TCRCEEG-----WTGPTC					614
EGF: domain 6 of 7, from 619 to 645: score 21.0, E = 0.027								
(SEQ ID NO:201)			CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC<-					
			+     ++    ++ +       +  ++  ++					
NOV15d	619		CHP--RCAEHGTCKDG-----KCECSHG-----WNGEHC					645
EGF: domain 7 of 7, from 650 to 680: score 17.2, E = 0.38								
(SEQ ID NO:202)			CapnnpCsngGtCvntpggssdnfggytCeCppGdyylsyGkrC<-					
			+   + +  +  + + +   +  +  +  +   +					
NOV15d	650		CPG--LCNSNGRCTLDQN-----GWHCVCPG-----WRGAGC					680
ATHILA: domain 1 of 1, from 1105 to 1122: score 3.2, E = 2.1								
(SEQ ID NO:203)			LPceevTsIierdnIdFk<-*					
			+  + +    ++  +  +  +					
NOV15d	1105		FPSGNVTSVLELRNKDFR		1122			
NHL: domain 1 of 2, from 1256 to 1283: score 9.8, E = 1.7								
(SEQ ID NO:204)			fdrPrGvavdpsdGqivVaDqsenhriqvF<-*					
			+ + +++ ++  +  +  +  +  +  +					
NOV15d	1256		LEWPTDLAINPMDNSIYVLD--NNVVLQIT					1283

```

NHL: domain 2 of 2, from 1385 to 1412: score 10.5, E = 1.3
(SEQ ID NO:205)      fdrPrGvavdpsdGqivVaDqsenhriqvF<-*
                    + | ++|+ +|| +++|| +| ||
NOV15d   1385      LSAPSSLAAS-PDGTLYIAD-LGNIRIRAV      1412

Glyco_hydro_38: domain 1 of 1, from 1733 to 1758: score 4.3, E = 1.3
(SEQ ID NO:206)      lkveFdeletGllksitrkqdnktvhvn<-*
                    ++| ++ || ++||+| ++ +|+++
NOV15d   1733      VNVTVS--STGQIASIQRGTTSEKVDYD      1758

```

EGF-like domain (IPR000561): A sequence of about thirty to forty amino-acid residues long found in the sequence of epidermal growth factor (EGF) has been shown to be present, in a more or less conserved form, in a large number of other, mostly animal proteins.

The list of proteins currently known to contain one or more copies of an EGF-like pattern is large and varied. The functional significance of EGF domains in what appear to be unrelated proteins is not yet clear. However, a common feature is that these repeats are found in the extracellular domain of membrane-bound proteins or in proteins known to be secreted (exception: prostaglandin G/H synthase). The EGF domain includes six cysteine residues which have been shown (in EGF) to be involved in disulfide bonds. The main structure is a two-stranded beta-sheet followed by a loop to a C-terminal short two-stranded sheet. Subdomains between the conserved cysteines vary in length. (Campbell I.D., Bork P., 1993, Curr. Opin. Struct. Biol. 3: 385-392; Weber I.T., Appella E., Blasi F., 1988, FEBS Lett. 231: 1-4; Doolittle R.F., Feng D.F., Johnson M.S., 1984, Nature 307: 558-560; Davis C.G., 1990, New Biol. 2: 410-419; Hunt L.T., Barker W.C., Blomquist M.C., 1984, Proc. Natl. Acad. Sci. U.S.A. 81: 7363-7367; Hunt L.T., Barker W.C., George D.G., Johnson G.C., 1986, Protein Nucleic Acid Enz. 29: 54-68).

This indicates that the sequence of the invention has properties similar to those of other proteins known to contain this/these domain(s) and similar to the properties of these domains.

The establishment of periodic patterns during the development of the *Drosophila* embryo is controlled by genes that act in a hierarchical manner (Nüsslein-Volhard and Wieschhaus, 1980, Nature 287: 795-801; Ingham 1988, Nature 335: 25-34; St. Johnston and Nüsslein-Volhard, 1992, Cell 68: 201-219). Maternal activities induce the expression of transcription factors, encoded by gap genes, which regulate the expression of other transcription factors encoded by pair rule genes. Pair rule genes are expressed in seven stripes along the anterior- posterior axis of *Drosophila melanogaster*. Their expression is crucial for the consecutive expression of segment polarity genes and the establishment of the segmental pattern of *Drosophila* embryos. Mutations in pair rule genes result in deletions of cuticle

segments which appear in a reiterative manner along the body axis of the hatched larvae. All known pair rule genes code for transcription factors, except for a gene identified independently in two laboratories and designated ten-m (Baumgartner et al., 1994, EMBO J. 13: 3728-3740) and odz (Levine et al., 1994, EMBO J. 13: 3728-3740). ten-m and odz are identical genes and mutations lead to a pair rule phenotype similar to odd-paired in which every other segment is missing (Nüsslein-Volhard et al., 1995, Cold Spring Harb. Symp. Quant. Biol. 50: 145-154). Despite the fact that both reports showed identical sequences, Ten-m was described as a secreted *Drosophila* tenascin-like molecule and Odz as a type I transmembrane receptor. Tenascins are a family of extracellular matrix proteins with a modular structure composed of fibronectin type III (FNIII) repeats, EGF-like repeats, and a COOH-terminal fibrinogen-like repeat (Erickson, 1993, Curr. Opin. Cell Biol. 5: 869-876). Biochemical studies using a *Drosophila* cell line indicated that Ten-m is a large secreted proteoglycan with chondroitinase ABC-sensitive chondroitin sulfate and/or dermatan sulfate side chains. The core protein was reported to contain EGF-like and FNIII repeats, but to lack the fibrinogen-like domain (Baumgartner et al., 1994, EMBO J. 13: 3728-3740). Odz was isolated as a novel phosphotyrosine-containing protein (Levine et al., 1994, Cell 77: 587-598). A transmembrane region was predicted COOH-terminal of the EGF repeats, followed by the cytoplasmic domain containing several tyrosine kinase phosphorylation consensus sites. More recently, Wang et al. (1998, EMBO J. 17: 3619-3630) described a mammalian orthologue of Ten-m/Odz, termed DOC4 (downstream of chop), which is induced by the stress-induced transcription factor CHOP. The open reading frame of DOC4 shares 31% sequence identity and 50% sequence similarity with Ten-m/Odz. Furthermore, DOC4 contains a short stretch of hydrophobic amino acids ~400 amino acids COOH-terminal of the putative start codon. This together with the cell surface localization led to the suggestion that DOC4 may constitute a type II transmembrane molecule. Ten-m/Odz, as well as DOC4, contains a stretch of eight consecutive EGF-like modules which are most similar to the EGF repeats of tenascins. EGF modules are structural units of proteins or parts of protein, located extracellularly. They can occur as isolated modules such as in reelin (D'Arcangelo et al., 1995, Nature. 374: 719-723) and in selectins (Whelan, 1996, Trends Biochem. Sci. 21: 65-69), or in arrays like in notch (Fleming et al., 1997, Development. 124: 2973-2981) and tenascins (Spring et al., 1989, Cell. 59: 325-334). A conserved feature of the EGF domain in Ten-m/Odz, DOC4, and Ten-a, a *Drosophila* molecule related to Ten-m/Odz (Baumgartner and Chiquet-Ehrismann, 1993, Mech. Dev. 40: 165-176), is the substitution of a cysteine residue with an aromatic amino acid in two of the eight EGF-like modules. This leaves two cysteines with no intramodular partner.

The importance of the integrity of the cysteine patterns in EGF-like modules is exemplified by the functional impairment of notch 3, which has been observed in patients with an autosomal dominant disorder causing stroke (Joutel et al., 1997, *Lancet*. 350: 1511-1515). The molecular basis of this disease is predominantly the substitution of cysteines with other amino acids in the EGF modules of notch 3. The observation that the EGF-like modules of Ten-m/Odz with five cysteines are ontogenetically conserved indicates that they are able to fold into a structure which might be important for the function of the protein.

Many genes that control pattern formation are expressed at several different periods during development to function in a variety of processes both during embryogenesis and postnatal life. After the initial expression in seven stripes at the cellular blastoderm stage, ten-m/odz is downregulated and appears at later stages in the central nervous system (CNS), dorsal vessel, trachea, and the eye and discs giving rise to the cephalic (antenna), ventral (wing), and dorsal (legs) thoracic appendages (Baumgartner et al., 1994, *EMBO J.* 13: 3728-3740; Levine et al., 1994, *EMBO J.* 13: 3728-3740). The highest level of Ten-m/Odz expression is observed in the CNS where the protein is deposited on the surface of axons (Levine et al., 1997, *Dev. Dyn.* 209: 1-14). The *Drosophila* eye disk is another location where high levels of Ten-m/Odz are found in very distinct sites including the morphogenetic furrow, photoreceptor-like cells, and nonepithelial cells of the eye disc (Levine et al., 1997, *Dev. Dyn.* 209: 1-14). The expression pattern of DOC4 in mammals is not well characterized but the presence of the mRNA has been demonstrated in the developing mouse brain (Wang et al., 1998, *EMBO J.* 17: 3619-3630).

Several mutations in the ten-m/odz gene have been identified, all resulting in embryonic lethality (Baumgartner et al., 1994, *EMBO J.* 13: 3728-3740; Levine et al., 1994, *EMBO J.* 13: 3728-3740). Due to the lack of viable hypomorphic mutations, it is not clear whether the protein executes an important function in all sites where it is expressed. One possible function for Ten-m/Odz comes from studies with DOC4 which has been isolated in search of GADD153/CHOP (growth arrest and DNA damage/ C/EBP homology protein)-induced mRNA. GADD153/ CHOP is responsive to many forms of stress, including alkylating agents, UV light, and conditions that trigger an ER stress response. For example, ER stress which occurs during ischemia alters proliferation of cells, induces cell death, and the expression of GADD153/CHOP (Zinszner et al., 1998, *Genes Dev.* 12: 982-995). Recent studies have shown that GADD153/ CHOP exerts at least part of its function via the induction of DOC4 and other proteins (Wang et al., 1998, *EMBO J.* 17: 3619-3630).

Recently, Oohashi et al. (1999, J. Cell Biol. 145: 563-577) have shown that at least four different cDNAs with similarity to the *Drosophila* ten-m/odz cDNA are expressed in mice. One of them, ten-m4, is identical to the DOC4 cDNA. The alignment of the four deduced mouse protein sequences indicated a strong conservation of the characteristic features for type II transmembrane molecules, which was also recognized for DOC4. In addition, the recombinant production of the putative extracellular domain of Ten-m1 revealed the formation of dimeric structures. The dimerization of Ten-m1 is mediated via the single cysteine residues in the EGF modules that lack their intramodular partners. Also, Ten-m1 is able to make homophilic interactions.

CD79 alpha is a subunit of an intracytoplasmic protein reported to be specific for B lymphocytes, including immature B lineage cells. To evaluate expression of the CD79 alpha antigen in acute myeloid leukemia (AML), we studied forty-eight cases of AML by paraffin section immunohistochemistry. The cases included four MO, nine M1, nine M2, ten M3, ten M4, and six M5 AMLs using criteria of the French-American-British cooperative group. Eleven cases demonstrated cytoplasmic staining for the CD79 alpha antigen, including one M1, nine M3, and one M5 AML. These CD79 alpha-positive cases represented 5% of all non-promyelocytic AMLs and 90% of all acute promyelocytic leukemias studied. All acute promyelocytic leukemias had the characteristic t(15;17)(q24;q21), including two cases of the microgranular variant (M3v). No other B-lineage-associated antigens were found in the CD79 alpha-positive cases, with the exception of a subpopulation of CD19-positive leukemic cells in one patient. The two non-promyelocytic leukemias that expressed CD79 alpha had no evidence of t(15;17) and did not express any additional B-lineage-associated antigens that might suggest a mixed lineage proliferation. This study demonstrates that CD79 alpha expression in acute leukemia is not restricted to B-lineage acute lymphoblastic leukemias and that CD79 alpha expression is frequently associated with t(15;17) acute myeloid leukemia.

## NOV16

NOV16 includes five novel Aldose Reductase-like proteins disclosed below. The disclosed sequences have been named NOV16a, NOV16b, NOV16c, NOV16d, and NOV16e. Unless specifically addressed as NOV16a, NOV16b, NOV16c, NOV16d, or NOV16e, any reference to NOV16 is assumed to encompass all variants.

## NOV16a

A disclosed NOV16a nucleic acid of 956 nucleotides (also referred to as CG55778-01)(SEQ ID NO:43) encoding a novel Aldose Reductase-like protein is shown in Table 16A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 31-33 and ending with a TGA codon at nucleotides 937-939. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined. The start and stop codons are in bold in Table 16A.

**Table 16A. NOV16a nucleotide sequence (SEQ ID NO:43)**

```
GGCGGGGCGGCGGGGCGGCCGGCGGGCGGCCATGGGAGATATCCCAGCCGTGGGCCTCAGC
TCCTGGAAGCAGGCTTCTCCAGGGAAAGTGACCGAGGCAGTGAAAGAGGCCATTGACGCA
GGGTACCGGCACCTTCGACTGTGCTTACTTTTACCACAATGAGAGGGAGGTTGGAGCAGGG
ATCCGTTGCAAGATCAAGGAAGGCGCTGTAAGACGGGAGGATCTGTTTCATTGCCACTAAG
CTGTGGTGACCTGCCATAAGAAGTCCTTGGTGGAAACAGCATGCAGAAAGAGTCTCAAG
GCCTTGAAGCTGAAGTATTTGGACCTCTACCTCATACACTGGCCCATGGGTTTCAAGCCT
CGAGTGACGAGACTTGCCCTCTGGACGAGAGCAACATGGTTATTCCAGTGACACGGAATTC
CTGGACACGTGGGAGGCCATGGAGGACCTGGTGATCACCGGGCTGGTGAAGAACATCGGG
GTGTCAAACCTTCAACCATGAACAGCTTGAGAGGCTTTTGAATAAGCCTGGGTTGAGGTTT
AAGCCACTAACCAACAGATTGAGTGCCACCCATATCTTACTCAGAAGAATCTGATCAGT
TTTTGCCAATCCAGAGATGTGTCCGTGACTGCTTACCGTCCTCTTGGTGGCTCTAGTGAG
GGGGTTGACCTGATAGACAACCTGTGATCAAGAGGATTGCAAAGGAGCACGGCAAGTCT
CCTGCTCAGATTTTGATCCGATTTCAAATCCAGAGGAATGTGATAGTGATCCCCGGATCT
ATCACCCCAAGTCACATTAAAGAGAATATCCAGGTGTTTGATTTTGAATTAACACAGCAC
GATATGGATAACATCCTCAGCCTAAACAGGAATCTCCGACTGGCCATGTTCCCCAGAAT
AAAAATCACAAAGACTATCCTTTCCACATAGAATACTGAGGACGCTTCCCTTCCT
```

The aldose reductase NOV16a disclosed in this invention maps to chromosome 10.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 740 of 922 bases (80%) identical to a gb:GENBANK-  
10 ID:MMU68535|acc:U68535.1 mRNA from Mus musculus (Mus musculus aldo-keto reductase mRNA, complete cds)

A disclosed NOV16a polypeptide (SEQ ID NO:44) encoded by SEQ ID NO:43 has 302 amino acid residues and is presented in Table 16B using the one-letter code. The SignalP, Psort and/or Hydropathy results predict that NOV16a has no signal peptide and is likely to be  
15 localized in the cytoplasm with a certainty of 0.6500. In an alternative embodiment, NOV16a is likely to be localized to the mitochondrial matrix space with a certainty of 0.1000 or to the lysosome (lumen) with a certainty of 0.1000.

**Table 16B. NOV16a protein sequence (SEQ ID NO:44)**

```
MGDIPAVGLSSWKQASPGKVTEAVKEAIDAGYRHFDCAIFYHNEREVGAGIRCKIKEGAV
RREDLFATKLWCTCHKSLVETACRKSALKALKNYLDLYLIHWPMGFKPRVQDLPLDES
```

NMVIPSDTDFLDTWEAMEDLVITGLVKNIQVSNFNHEQLERLLNKPGLRFRKPLTNQIECH  
PYLTQKNLISFCQSRDVSVTAYRPLGGSSEGVLDIDNPVIKRIAKEHGKSPAQILIRFQI  
QRNVIVIPGSITPSHIKENIQVDFELTQHDMDNILSLNRNRLAMFPRTKNHKDYPFHI  
EY

The full amino acid sequence of the protein of the invention was found to have 223 of 302 amino acid residues (73%) identical to, and 259 of 302 amino acid residues (85%) similar to, the 301 amino acid residue ptnr:SPTREMBL-ACC:O09125 protein from *Mus musculus* (Mouse) (ALDO-KETO REDUCTASE).

- 5 The aldose reductase disclosed in this invention is expressed in at least the following tissues: lung, testis, germ cell. The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from: cancer, trauma,
- 10 regeneration (in vitro and in vivo), viral/bacterial/parasitic infections, systemic lupus erythematosus, autoimmune disease, asthma, emphysema, scleroderma, allergy, ARDS, infertility and other diseases, disorders and conditions of the like.

#### NOV16b

- 15 A disclosed NOV16b nucleic acid of 875 nucleotides (also referred to as CG55778-02)(SEQ ID NO:45) encoding a novel Aldose Reductase-like protein is shown in Table 16C. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 23-25 and ending with a TGA codon at nucleotides 776-778. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined. The start and stop codons are in bold in Table 16C.

**Table 16C. NOV16b nucleotide sequence (SEQ ID NO:45)**

GGCGGGGCGGCCGGCGGGCGGCC**AT**GGGAGATATCCCAGCCGTGGGCCTCAGCTCCTGGAA  
GCAGGCTTCTCCAGGAAAAGTGACCGAGGCAGTGAAAGAGGCCATTGACGCAGGGTACCG  
GCACTTCGACTGTGCTTACTTTTACCACAATGAGAGGGAGGTTGGAGCAGGGATCCGTTG  
CAAGATCAAGGAAGGCGCTGTAAGACGGGAGGATCTGTTTCATTGCCACTAAGCTGTGGTG  
CACCTGCCATAAGAAGTCCTTGGTGAAACAGCATGCAGAAAGGGTCTCAAGGCCTTGAA  
GCTGAACTATTTGGACCTCTACCTCATACTGGCCCATGGGTTTCAAGCCTCCTCATCC  
AGAATGGATCATGAGCTGCAGTGAACCTTTCCTTCTGCCTCTCACATCCTCGAGTGCAGGA  
CTTGCCCTCTGGACGAGAGCAACATGGTTATTCCCAGTGACACGGACTTCCTGGACACGTG  
GGAGGCCATGGAGGACCTGGTGATCACCGGGCTGGTGAAGAACATCGGGGTGTCAAACCTT  
CAACCATGAACAGCTTGAGAGGCTTTTGAATAAGCCTGGGTTGAGGTTCAAGCCACTAAC  
CAACCAGATTTTGATCCGATTTCAAATCCAGAGGAATGTGATAGTGATCCCCGGATCTAT  
CACCCCAAGTCACATTAAAGAGAATATCCAGGTGTTGATTTTGAATTAACACAGCACGA  
TATGGATAACATCCTCAGCCTAAACAGGAATCTCCGACTGGCCATGTTCCCATGT**AAAT**  
ATGGCTCCTTCTTTTAAACAGAGGGAAGAATATACAGATTGAATGATTGGTGTCTGAA  
TAGAACTAAAAATCACAAGACTATCCTTTCCACA



NOV16b is a splice form of CG55778\_01 with an alternatively spliced exon 4, deletion of exon 6 and 7, and a different C-terminus with exon 10 missing. The aldose reductase NOV16b disclosed in this invention maps to chromosome 10.

5 In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 634 of 657 bases (96%) identical to a gb:GENBANK-ID:AF263242|acc:AF263242.1 mRNA from Homo sapiens (Homo sapiens aldo-keto reductase loopADR mRNA, complete cds).

10 A disclosed NOV16b polypeptide (SEQ ID NO:46) encoded by SEQ ID NO:45 has 251 amino acid residues and is presented in Table 16D using the one-letter code. The SignalP, Psort and/or Hydropathy results predict that NOV16b has no signal peptide and is likely to be localized in the cytoplasm with a certainty of 0.4500. In an alternative embodiment, NOV16b is likely to be localized to the microbody (peroxisome) with a certainty of 0.1047, or to the mitochondrial matrix space with a certainty of 0.1000, or to the lysosome (lumen) with a certainty of 0.1000.

**Table 16D. NOV16b protein sequence (SEQ ID NO:46)**

MGDI PAVGLSSWKQASPGKVTEAVKEAIDAGYRHFDCAYFYHNEREVGAGIRCKIKEGAV RREDLFIATKLWCTCHKSLVETACRGLKALKLNLYLDLYLIHWPMGFKPPHPEWIMSCS ELSFCLSHPRVQDLPLDESNMVIPSDTDFLDTWAMEDLVITGLVKNIGVSNFNHEQLER LLNKPGLRFKPLTNQILIRFQIQNRNVIVIPGSITPSHIKENIQVDFELTQHMDNLSL NRNLR LAMFPM
---

15 The full amino acid sequence of the protein of the invention was found to have 197 of 207 amino acid residues (95%) identical to, and 200 of 207 amino acid residues (96%) similar to, the 320 amino acid residue ptrn:TREMBLNEW-ACC:AAK58523 protein from Homo sapiens (Human) (ALDO-KETO REDUCTASE LOOPADR).

20 The ALDOSE REDUCTASE-like gene disclosed in this invention is expressed in at least the following tissues: lung, testis, germ cell. The nucleic acids and proteins of the invention have applications in the diagnosis and/or treatment of various diseases and disorders. For example, the compositions of the present invention will have efficacy for the treatment of patients suffering from: cancer, trauma, regeneration (in vitro and in vivo), viral/bacterial/parasitic infections, systemic lupus erythematosus, autoimmune disease,

[illegible]

**Table 16E. NOV16c nucleotide sequence (SEQ ID NO:47)**

GGCGGGGCGGCCGGCGGCCATGGGAGATATCCCAGCCGTGGGCCTCAGCTCCTGGAA  
GCAGGCTTCTCCAGGTAAAGTGACCGAGGCAGTGAAAGAGGCCATTGACGCAGGGTACCG  
GCACCTCGACTGTGCTTACTTTTACCACAATGAGAGGGAGGTTGGAGCAGGGATCCGTTG  
CAAGATCAAGGAAGGCGCTGTAAGACGGGAGGACTCTGTTCAATGCCACTAAGCTGTGGTG  
CACCTGCCATAAGAAGTCTTGGTGAAACAGCATGCAGAAAGAGTCTCAAGGCCTTGAA  
GCTGAACATTTTGGACCTCTACCTCATACACTGGCCCCATGGGTTTCAAGCCTCCTCATCC  
AGAATGGATCATGAGCTGCAGTGAACCTTCTTCTGCCTCTCACATCCTCGAGTGCAGGA  
CTTGCCTCTGGACGAGAGCAACATGGTTATTCCCAGTGACACGGACTTCCTGGACACGTG  
GGAGATTTTGATCCGATTTCAAATCCAGAGGAATGTGATAGTGATCCCCGGATCTATCAC  
CCCAAGTCACATTAAAGAGAATATCCAGGTGTTTGATTTTGAATTAACACAGCACGATAT  
GGATAACATCCTCAGCCTAAACAAGAATCTCCGACTGGCCATGTTCCCCATGTA  
GCTCCTTCTTTTAAACAGAGGGAAGAATATACAGATTGAATGATTGGTGTCTGAATAG  
AACTAAAAATCACAAGACTATCCTTTCACA

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 478 of 482 bases (99%) identical to a gb:GENBANK-ID:AF263242|acc:AF263242.1 mRNA from Homo sapiens (Homo sapiens aldo-keto reductase loopADR mRNA, complete cds).

142

mitochondrial matrix space with a certainty of 0.1000, or to the lysosome (lumen) with a certainty of 0.1000.

**Table 16F. NOV16c protein sequence (SEQ ID NO:48)**

MGDIPAVGLSSWKQASPGKVTEAVKEAIDAGYRHFDCAFYHNEREVGAGIRCKIKEGAV RREDLFIATKLWCTCHKKSLVETACRKSALKALKNYLDLYLIHWPMGFKPPHPEWIMSCS ELSFCLSHPRVQDLPLDESNMVIPSDTDFLDTWEILIRFQIQNVIVIPGSITPSHIKEN IQVFDFELTQHDMDNILSLNKNLRLAMFPM
--

The full amino acid sequence of the protein of the invention was found to have 153 of 156 amino acid residues (98%) identical to, and 154 of 156 amino acid residues (98%) similar to, the 307 amino acid residue ptnr:SPTREMBL-ACC:Q9BU71 protein from Homo sapiens (Human) (SIMILAR TO ALDO-KETO REDUCTASE).

The Aldo-Keto Reductase-like gene disclosed in this invention is expressed in at least the following tissues: lung, testis, germ cell. The sequence is predicted to be expressed in the following tissues because of the expression pattern of (GENBANK-ID: gb:GENBANK-ID:AF263242|acc:AF263242.1) a closely related Homo sapiens aldo-keto reductase loopADRMRNA, complete cds homolog in species Homo sapiens : small intestine.

The nucleic acids and proteins of the invention have applications in the diagnosis and/or treatment of various diseases and disorders. For example, the compositions of the present invention will have efficacy for the treatment of patients suffering from: cancer, trauma, regeneration (in vitro and in vivo), viral/bacterial/parasitic infections, systemic lupus erythematosus, autoimmune disease, asthma, emphysema, scleroderma, allergy, ARDS, infertility, as well as other diseases, disorders and conditions.

#### NOV16d

A disclosed NOV16d nucleic acid of 785 nucleotides (also referred to as CG55778-04)(SEQ ID NO:49) encoding a novel Aldose Reductase-like protein is shown in Table 16G. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 31-33 and ending with a TGA codon at nucleotides 766-768. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined. The start and stop codons are in bold in Table 16G.

**Table 16G. NOV16d nucleotide sequence (SEQ ID NO:49)**

GGCGGGGCGGCGGGGCGGCCGGCGGCC <b>AT</b> GGGAGATATCCCAGCCGTGGGCCTCAGC
--

TCCTGGAAGCAGGCTTCTCCAGGGAAAGTGACCGAGGCAGTGAAAGAGGCCATTGACGCA  
GGGTACCGGCACCTTCGACTGTGCTTACTTTTACCACAATGAGAGGGAGGTTGGAGCAGGG  
ATCCGTTGCAAGATCAAGGAAGGCGCTGTAAGACGGGAGGATCTGTTTCATTGCCACTAAG  
CTGTGGTGCACCTGCCATAAGAAGTCCTTGGTGGAAACAGCATGCAGAAAGAGTCTCAAG  
GCCTTGAAGCTGAAGTATTTGGACCTCTACCTCATACTGGCCCATGGGTTTCAAGCCT  
CGAGTGCAGGACTTGCCCTCTGGACGAGAGCAACATGGTTATTCCCAGTGACACGGACTTC  
CTGGACACGTTGGGAGGCCATGGAGGACCTGGTGATCACCGGGCTGGTGAAGAACATCGGG  
GTGTCAAACCTTCAACCATGAACAGCTTGAGAGGCTTTTGAATAAGCCTGGGTTGAGGTTT  
AAGCCACTAACCAACAGATTTTGATCCGATTTCAAATCCAGAGGAATGTGATAGTGATC  
CCCGGATCTATCACCCCAAGTCACATTAAAGAGAATATCCAGGTGTTTGATTTTGAATTA  
ACACAGCACGATATGGATAACATCCTCAGCCTAAACAGGAATCTCCGACTGGCCATGTTT  
CCCAGAATAAAAATCACAAGACTATCCTTTCCACATAGAATACTGAGGACGCTTCCCC  
TTCCT

The aldose reductase NOV16d disclosed in this invention maps to chromosome 10.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 358 of 361 bases (99%) identical to a gb:GENBANK-  
ID:BC002862|acc:BC002862.1 mRNA from Homo sapiens (Homo sapiens, Similar to aldo-  
5 keto reductase, clone MGC:10612 IMAGE:3941289, mRNA, complete cds)

A disclosed NOV16d polypeptide (SEQ ID NO:50) encoded by SEQ ID NO:49 has 245 amino acid residues and is presented in Table 16H using the one-letter code. The SignalP, Psort and/or Hydropathy results predict that NOV16d has no signal peptide and is likely to be localized in the cytoplasm with a certainty of 0.4500. In an alternative embodiment, NOV16d  
10 is likely to be localized to the lysosome (lumen) with a certainty of 0.1602, or to the microbody (peroxisome) with a certainty of 0.1369, or to the mitochondrial matrix space with a certainty of 0.1000.

**Table 16H. NOV16d protein sequence (SEQ ID NO:50)**

MGDIPAVGLSSWKQASPGKVTEAVKEAIDAGYRHFDCAYFYHNEREVGAGIRCKIKEGAV  
RREDLFIATKLWCTCHKKSLVETACRKSALKALKNLYLDLYLIHWPMGFKPRVQDLPLDES  
NMVIPSDTDFLDTWEAMEDLVITGLVKNIGVSNFNHEQLERLLNKPGLRFRKPLTNQILIR  
FQIQRNIVIVPGSITPSHIKENIQVDFELTQHMDNLSLNRNLRLLAMFPRTKNHKDYP  
FHIEY

The full amino acid sequence of the protein of the invention was found to have 109 of 110 amino acid residues (99%) identical to, and 109 of 110 amino acid residues (99%) similar  
15 to, the 307 amino acid residue ptrn:SPTREMBL-ACC:Q9BU71 protein from Homo sapiens (Human) (SIMILAR TO ALDO-KETO REDUCTASE).

The ALDO-KETO REDUCTASE-like gene disclosed in this invention is expressed in at least the following tissues: Adipose, Testis. The nucleic acids and proteins of the invention have applications in the diagnosis and/or treatment of various diseases and disorders. For

example, the compositions of the present invention will have efficacy for the treatment of patients suffering from: cancer, trauma, regeneration (in vitro and in vivo), viral/bacterial/parasitic infections, systemic lupus erythematosus, autoimmune disease, asthma, emphysema, scleroderma, allergy, ARDS, infertility and other diseases as well as other diseases, disorders and conditions.

#### NOV16e

A disclosed NOV16e nucleic acid of 937 nucleotides (also referred to as CG55778-05)(SEQ ID NO:51) encoding a novel Aldose Reductase-like protein is shown in Table 16I. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 31-33 and ending with a TAA codon at nucleotides 838-840. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined. The start and stop codons are in bold in Table 16I.

**Table 16I. NOV16e nucleotide sequence (SEQ ID NO:51)**

GGCGGGGCGGCGGGGCGGCCGGCGGCGGCATGGGAGATATCCAGCCGTGGGCCTCAGC  
TCCTGGAAGCAGGCTTCTCCAGGGAAAGTGACCGAGGCAGTGAAAGAGGCCATTGACGCA  
GGGTACCGGCACCTTCGACTGTGCTTACTTTTACCACAATGAGAGGGAGGTTGGAGCAGGG  
ATCCGTTGCAAGATCAAGGAAGGCGCTGTAAGACGGGAGGATCTGTTTATTGCCACTAAG  
CCTCCTCATCCAGAATGGATCATGAGCTGCAGTGAACCTTTCCTTCTGCCTCTCACATCCT  
CGAGTGCAGGACTTGCTCTGGACGAGAGCAACATGGTTATTCCAGTGACACGGACTTC  
CTGGACACGTGGGAGGCCATGGAGGACCTGGTGATCACCGGGCTGGTGAAGAACATCGGG  
GTGTCAAACCTTCAACCATGAACAGCTTGAGAGGCTTTTGAATAAGCCTGGGTTGAGGTTT  
AAGCCACTAACCAACCAGATTGAGTGCCACCCATATCTTACTCAGAAGAATCTGATCAGT  
TTTGGCCAATCCAGAGATGTGTCCGTGACTGCTTACCGTCCTCTGGTGGCTCGTGTGAG  
GGGGTTGACCTGATAGACAACCTGTGATCAAGAGGATTGCAAAGGAGCACGGCAAGTCT  
CCTGCTCAGATTTTGATCCGATTTCAAATCCAGAGGAATGTGATAGTGATCCCCGATCT  
ATCACCCCAAGTCACATTAAAGAGAATATCCAGGTGTTTGAATTTGAATTAACACAGCAC  
GATATGGATAACATCTCAGCCTAAACAGGAATCTCCGACTGGCCATGTTCCCCATGTAA  
ATATGGCTCCTTCTTTTAAAAACAGAGGAAGAATATACAGATTGAATGATTGGTGTCTG  
AATAGAACTAAAAATCACAAAGACTATCCTTTCCACA

The aldose reductase NOV16e disclosed in this invention maps to chromosome 10.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 700 of 700 bases (100%) identical to a gb:GENBANK-ID:BC002862|acc:BC002862.1 mRNA from Homo sapiens (Homo sapiens, Similar to aldoketo reductase, clone MGC:10612 IMAGE:3941289, mRNA, complete cds).

A disclosed NOV16e polypeptide (SEQ ID NO:52) encoded by SEQ ID NO:51 has 269 amino acid residues and is presented in Table 16J using the one-letter code. The SignalP, Psort and/or Hydropathy results predict that NOV16e has no signal peptide and is likely to be

localized in the cytoplasm with a certainty of 0.4500. In an alternative embodiment, NOV16e is likely to be localized to the lysosome (lumen) with a certainty of 0.1602, or to the microbody (peroxisome) with a certainty of 0.1369, or to the mitochondrial matrix space with a certainty of 0.1000.

Table 16J. NOV16e protein sequence (SEQ ID NO:52)

MGDIPAVGLSSWKQASPGKVTEAVKEAIDAGYRHFDCAIFYHNEREVGAGIRCKIKEGAV  
RREDLFIATKPPHPPEWIMSCSELSFCLSHPRVQDLPLDESNMVIPSDTDFLDTWEAMEDL  
VITGLVKNIQVSNFNHEQLERLLNKPGLRFPKPLTNQIECHPYLTQKNLISFCQSRDVSVT  
AYRPLGGSCGVDLIDNPVIKRIAKEHGKSPAQILIRFQIQNRNIVIVIPGSITPSHIKENI  
QVDFDFELTQHMDNLSLNRNRLRLAMFPM

5           The full amino acid sequence of the protein of the invention was found to have 206 of 233 amino acid residues (88%) identical to, and 211 of 233 amino acid residues (90%) similar to, the 307 amino acid residue ptnr:SPTREMBL-ACC:Q9BU71 protein from Homo sapiens (Human) (SIMILAR TO ALDO-KETO REDUCTASE).

10           The ALDO-KETO REDUCTASE-like gene disclosed in this invention is expressed in at least the following tissues: Adipose, Testis. The nucleic acids and proteins of the invention have applications in the diagnosis and/or treatment of various diseases and disorders. For example, the compositions of the present invention will have efficacy for the treatment of patients suffering from: cancer, trauma, regeneration (in vitro and in vivo), viral/bacterial/parasitic infections, systemic lupus erythematosus, autoimmune disease,  
15           asthma, emphysema, scleroderma, allergy, ARDS, infertility and other diseases as well as other diseases, disorders and conditions.

NOV16a, NOV16b, NOV16c, NOV15d and NOV15e are very closely homologous as is shown in the amino acid alignment in Table 16K.

Table 16K. Clustal W Alignment of NOV16a and NOV16b and NOV16c and NOV16d and NOV16e

	10	20	30	40	50	60	70	80
CG55778_01	.....	.....	.....	.....	.....	.....	.....	.....
CG55778_02	.....	.....	.....	.....	.....	.....	.....	.....
CG55778_03	.....	.....	.....	.....	.....	.....	.....	.....
CG55778_04	.....	.....	.....	.....	.....	.....	.....	.....
CG55778_05	.....	.....	.....	.....	.....	.....	.....	.....
	90	100	110	120	130	140	150	160
CG55778_01	.....	.....	.....	.....	.....	.....	.....	.....
CG55778_02	.....	.....	.....	.....	.....	.....	.....	.....
CG55778_03	.....	.....	.....	.....	.....	.....	.....	.....
CG55778_04	.....	.....	.....	.....	.....	.....	.....	.....
CG55778_05	.....	.....	.....	.....	.....	.....	.....	.....
	170	180	190	200	210	220	230	240

CG55778_01	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	ITGLVKNIGVSNFNHEQLERLLNKPGLRFPKPLT	IT
------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	------------------------------------	----

In a search of public sequence databases, NOV16a was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 16L.

**Table 16L. BLASTP results for NOV16a**

Gene Index/ Identifier	Protein/Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SPTREMBL- ACC:Q96JD6	ALDO-KETO REDUCTASE LOOPADR - Homo sapiens	320	190/193 (98%)	190/193 (98%)	1.8e-159
ptnr:SPTREMBL- ACC:Q9BU71	SIMILAR TO ALDO-KETO REDUCTASE - Homo sapiens	307	178/179 (99%)	178/179 (99%)	5.8e-152
ptnr:SPTREMBL- ACC:Q9DCT1	1810061I10RIK PROTEIN (RIKEN CDNA 1810061I10 GENE) - Mus musculus	301	225/302 (74%)	260/302 (86%)	5.0e-124
ptnr:SPTREMBL- ACC:O09125	ALDO-KETO REDUCTASE - Mus musculus	301	223/302 (73%)	259/302 (85%)	3.5e-123
ptnr:SPTREMBL- ACC:Q9D8L2	1810061I10RIK PROTEIN - Mus musculus	276	205/274 (74%)	235/274 (85%)	9.8e-112

Other BLAST results include sequences from the Patp database, which is a propriety database that contains sequences published in patents and patent publications. Patp results include those listed in Table 16M.

**Table 16M. Patp BLASTP Analysis for NOV16a**





```

229 ---KSPAQILIRFQIQRN-----VIVIPGSITPSHIKENIQVF-DFELTQ 269

      edmkaideldrgk<-*
      ||+ | +|+|+
270 HDMDNILSLNRNL      282

```

In a search of public sequence databases, NOV16b was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 16O.

**Table 16O. BLASTP results for NOV16b**

Gene Index/ Identifier	Protein/Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SPTREMBL- ACC:Q9BU71	SIMILAR TO ALDO-KETO REDUCTASE - Homo sapiens	307	197/207 (95%)	200/207 (96%)	1.4e-105
ptnr:SPTREMBL- ACC:Q96JD6	ALDO-KETO REDUCTASE LOOPADR - Homo sapiens	320	197/207 (95%)	200/207 (96%)	1.4e-105
ptnr:SPTREMBL- ACC:Q9DCT1	1810061I10RIK PROTEIN (RIKEN CDNA 1810061I10 GENE) - Mus musculus	301	82/110 (74%)	93/110 (84%)	4.3e-91
ptnr:SPTREMBL- ACC:O09125	ALDO-KETO REDUCTASE - Mus musculus	301	81/110 (73%)	93/110 (84%)	3.0e-90
ptnr:SPTREMBL- ACC:Q9D8L2	1810061I10RIK PROTEIN - Mus musculus	276	82/110 (74%)	93/110 (84%)	2.9e-86

- 5 Other BLAST results include sequences from the Patp database, which is a propriety database that contains sequences published in patents and patent publications. Patp results include those listed in Table 16P.

**Table 16P. Patp BLASTP Analysis for NOV16b**

Sequences producing High- scoring Segment Pairs	Protein/Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAM79279	Human protein SEQ ID NO 1941 - Homo sapiens	263	246/251 (98%)	247/251 (98%)	3.0e-133
patp:AAM80263	Human protein SEQ ID NO 3909 - Homo sapiens	264	195/207 (94%)	198/207 (95%)	1.2e-104
patp:AAR15425	Human aldose reductase - Homo sapiens	316	68/107 (63%)	84/107 (78%)	1.1e-73
patp:AAR06652	Placenta-specific protein-9 - Homo sapiens	316	67/107 (62%)	84/107 (78%)	2.3e-73
patp:AAW69357	Rat lens aldose reductase - Rattus sp	316	66/107 (61%)	84/107 (78%)	2.9e-73

- 10 Table 16Q lists the domain description from DOMAIN analysis results against NOV16b.

**Table 16Q. Domain Analysis of NOV16b**

Pfam analysis						
Model	Domain	seq-f	seq-t	hmm-f	hmm-t	score E-value

[illegible]

5

10

invention has properties similar to those of other proteins known to contain this/these domain(s) and similar to the properties of these domains.

The aldo-keto reductase family includes a number of related monomeric NADPH-dependent oxidoreductases, such as aldose reductase, prostaglandin F synthase, xylose reductase, aldehyde reductases, hydroxysteroid dehydrogenases, dihydrodiol dehydrogenases and many others. All possess a similar structure, with a beta-alpha-beta fold characteristic of nucleotide binding proteins. The fold comprises a parallel beta-8/alpha-8-barrel, which contains a novel NADP-binding motif. The (alpha/beta)8-barrel fold provides a common scaffold for an NAD(P)(H)-dependent catalytic activity, with substrate specificity determined by variation of loops on the C-terminal side of the barrel. All the aldo-keto reductases are dependent on nicotinamide cofactors for catalysis and retain a similar cofactor binding site, even among proteins with less than 30% amino acid sequence identity. *See Jez JM, et al., Biochem J* 1997 Sep 15;326 ( Pt 3):625-36. Rabbit aldose reductase, which catalyzes the conversion of glucose to sorbitol (an organic osmolyte), is induced in renal medullary cells under hyperosmotic conditions. *See Ferraris JD, et al., Proc. Natl. Acad. Sci. U S A* 1994 Oct 25;91(22):10742-6.

#### NOV17

A disclosed NOV17 nucleic acid of 884 nucleotides (also referred to as CG55982-01) (SEQ ID NO:53) encoding a novel apolipoprotein A-I-like protein is shown in Table 17A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 87-89 and ending with a TGA codon at nucleotides 807-809. Putative untranslated regions are found upstream from the initiation codon and downstream from the termination codon, and are underlined. The start and stop codons are shown in bold in Table 17A.

**Table 17A. NOV17 nucleotide sequence (SEQ ID NO:53)**

<p>GAATTCAAAAAAAAAGAAAAAAAAAAAAAAAAAAAAAAAAAGAGAGACTGCGAG  AAGGAGGTCCCCACGGCCCTCAGGATGAAAGCTGCGGTGCTGACCTTGGCCGTGCTCT  TCCTGACGGGGAGCCAGGCTCGGCATTTCTGGCAGCAAGATGAACCCCCCAGAGCCCCT  GGGATCGAGTGAAAGGACCTGGCCACTGTGTACGTGGATGTGCTCAAAGACAGCGTGACCT  CCACCTTCAGCAAGCTGCGCGAACAGCTCGGCCCTGTGACCCAGGAGTTCTGGGATAACC  TGGAAGAGGAGACAGAGGGCTGAGGCAGGAGATGAGCAAGGATCTGGAGGAGGTGAAGG  CCAAGGTGCAGCCCTACCTGGACGACTTCCAGAAGAAGTGGCAGGAGGAGATGGAGCTCT  ACCGCCAGAAGGTGGAGCCGCTGCGCGCAGAGCTCAAGAGGGCGCGGCCAGAAGCTGC  ACGAGCTGCAAGAGAAGCTGAGCCCACTGGGCGAGGAGATGCGCGACCGCGCGCGCCCC  ATGTGGACGCGCTGCGCACGCATCTGGCCCCCTACAGCGACGAGCTGCGCCAGCGCTTGG  CCGCGCGCCTTGAGGCTCTCAAGGAGAACGGCGGCGCCAGACTGGCCGAGTACCACGCCA  AGGCCACCGAGCATCTGAGCACGCTCAGCGAGAAGGCCAAGCCCGCGCTCGAGGACCTCC  GCCAAGGCCTGCTGCCCCTGCTGGAGAGCTTCAAGGTCAGCTTCTGAGCGCTCTCGAGG  AGTACACTAAGAAGCTCAACACCCAGTGAGGCGCCCGCCGCCCCCTTCCCGGTGCT</p>
--

CAGAATAAACGTTTCCAAAGTGGGAAAAAAAAAAAAAGAATTC

The apolipoprotein A-I-like NOV17 disclosed in this invention maps to the long arm of chromosome 11.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 637 of 637 bases (100%) identical to a gb:GENBANK-  
5 ID:HUMAPOAIB|acc:M27875.1 mRNA from Homo sapiens (Human apolipoprotein A-I mRNA, complete cds).

A disclosed NOV17 polypeptide (SEQ ID NO:54) encoded by SEQ ID NO:53 240 amino acid residues and is presented in Table 17B using the one-letter code. The SignalP, Psort and/or Hydropathy results predict that NOV17 has a signal peptide and is likely to be  
10 localized extracellularly with a certainty of 0.3700, as expected by a member of the apolipoprotein A1/A4/E family. In an alternative embodiment, NOV17 is likely to be localized to the endoplasmic reticulum (membrane) with a certainty of 0.1000, or to the endoplasmic reticulum (lumen) with a certainty of 0.1000, or to the microbody (peroxisome) with a certainty of 0.1000. Most likely cleavage site for the signal peptide is between amino  
15 acids 18 and 19, i.e., at the dash in the sequence SQA-RH.

**Table 17B. NOV17 protein sequence (SEQ ID NO:54)**

MKAAVLTLAVLFLTGSQARHFWQQDEPPQSPWDRVKDLATVYVDVLKDSVTSTFSKLRQ  
LGPVTQEFWDNLEKETEGLRQEMSKDLEEVKAKVQPYLDDFQKKWQEEMELYRQKVEPLR  
AELQEGARQKLHELQEKLSPLGEEMDRARAHVDALRTHLAPYSDELRLQRLAARLEALKE  
NGGARLABYHAKATEHLSTLSEKAKPALEDLRQGLLPVLESFKVSFLSALEEYTKKLNTQ

The full amino acid sequence of the protein of the invention was found to have 193 of 193 amino acid residues (100%) identical to, and 193 of 193 amino acid residues (100%) similar to, the 267 amino acid residue ptnr:SWISSPROT-ACC:P02647 protein from Homo sapiens (Human) (APOLIPOPROTEIN A-I PRECURSOR (APO-AI))(Fig. 3B). The sequence  
20 of this invention lacks 27 internal amino acids when compared to ptnr:SWISSPROT-ACC:P02647 protein from Homo sapiens (Human) (APOLIPOPROTEIN A-I PRECURSOR (APO-AI)).

In a search of public sequence databases, NOV17 was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 17C.

**Table 17C. BLASTP results for NOV17**

Gene Index/ Identifier	Protein/Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SWISSPROT- ACC:P02647	Apolipoprotein A-I precursor (Apo-AI) - Homo sapiens	267	193/193 (100%)	193/193 (100%)	9.5e-98
ptnr:TREMBLNEW- ACC:AAA51747	APOA1 PROTEIN - Homo sapiens	249	193/193 (100%)	193/193 (100%)	9.5e-98
ptnr:REMTREMBL- ACC:CAA00975	APOA1 PROTEIN - Homo sapiens	243	193/193 (100%)	193/193 (100%)	9.5e-98
ptnr:REMTREMBL- ACC:CAA03490	SEQUENCE 10 FROM PATENT WO9637608 - unidentified	200	192/193 (99%)	192/193 (99%)	6.7e-97
ptnr:SWISSPROT- ACC:P15568	Apolipoprotein A-I precursor (Apo-AI) - Macaca fascicularis (Crab eating macaque) (Cynomolgus monkey)	267	186/193 (96%)	189/193 (97%)	3.8e-94

A multiple sequence alignment is shown in Table 17D, with the protein of the invention being shown on the first line in a ClustalW analysis comparing the protein of the invention with related protein sequences shown in Table 17C.

**Table 17D. ClustalW Analysis of NOV17**

1) NOV17 CG55982-01	(SEQ ID NO:54)
2) P02647	(SEQ ID NO:219)
3) AAA51747	(SEQ ID NO:220)
4) CAA00975	(SEQ ID NO:221)
5) CAA03490	(SEQ ID NO:222)
6) P15568	(SEQ ID NO:223)

	10	20	30	40	50	60	70	80
NOV17	MKAAVLTLAVLFLTGSA	RHFVQDDEPPQSPWDRVKDLATVYVDVLKDS	-----	VTST				
P02647	MKAAVLTLAVLFLTGSA	RHFVQDDEPPQSPWDRVKDLATVYVDVLKDS	GRVVSQFEGSALGKQLNLKLLDNWDSVTST					
AAA51747	-----	RHFVQDDEPPQSPWDRVKDLATVYVDVLKDS	GRVVSQFEGSALGKQLNLKLLDNWDSVTST					
CAA00975	-----	DEPPQSPWDRVKDLATVYVDVLKDS	GRVVSQFEGSALGKQLNLKLLDNWDSVTST					
CAA03490	-----	-----	-----	-----	-----	-----	-----	-----
P15568	MKATVLTAVLFLTGSA	RHFVQDDEPPQSPWDRVKDLATVYVDVLKDS	GRVVSQFEGSALGKQLNLKLLDNWDSVTST					

	90	100	110	120	130	140	150	160
NOV17	FSKLRQLGPVTQEFWDNLEKETEGLRQEMSKDLBEVKAKVQPYLDDFQKKWQEE	MELYRQKVEPLRAELQEGARQKLHE						
P02647	FSKLRQLGPVTQEFWDNLEKETEGLRQEMSKDLBEVKAKVQPYLDDFQKKWQEE	MELYRQKVEPLRAELQEGARQKLHE						
AAA51747	FSKLRQLGPVTQEFWDNLEKETEGLRQEMSKDLBEVKAKVQPYLDDFQKKWQEE	MELYRQKVEPLRAELQEGARQKLHE						
CAA00975	FSKLRQLGPVTQEFWDNLEKETEGLRQEMSKDLBEVKAKVQPYLDDFQKKWQEE	MELYRQKVEPLRAELQEGARQKLHE						
CAA03490	FSKLRQLGPVTQEFWDNLEKETEGLRQEMSKDLBEVKAKVQPYLDDFQKKWQEE	MELYRQKVEPLRAELQEGARQKLHE						
P15568	VSKLRQLGPVTQEFWDNLEKETEGLRQEMSKDLBEVKAKVQPYLDDFQKKWQEE	MELYRQKVEPLRAELQEGARQKLHE						

	170	180	190	200	210	220	230	240
NOV17	LQEKLSPLGEE	MRDRAHVDALRTHLAPYSDEL	RQLAARLEALKENG	GARLA	EYHAKATEHLSTLSEKAKPA	EDLRQ		
P02647	LQEKLSPLGEE	MRDRAHVDALRTHLAPYSDEL	RQLAARLEALKENG	GARLA	EYHAKATEHLSTLSEKAKPA	EDLRQ		
AAA51747	LQEKLSPLGEE	MRDRAHVDALRTHLAPYSDEL	RQLAARLEALKENG	GARLA	EYHAKATEHLSTLSEKAKPA	EDLRQ		
CAA00975	LQEKLSPLGEE	MRDRAHVDALRTHLAPYSDEL	RQLAARLEALKENG	GARLA	EYHAKATEHLSTLSEKAKPA	EDLRQ		
CAA03490	LQEKLSPLGEE	MRDRAHVDALRTHLAPYSDEL	RQLAARLEALKENG	GARLA	EYHAKATEHLSTLSEKAKPA	EDLRQ		
P15568	LQEKLSPLGEE	MRDRAHVDALRTHLAPYSDEL	RQLAARLEALKENG	GARLA	EYHAKATEHLSTLSEKAKPA	EDLRQ		

	250	260
NOV17	GLLPVLESFKVSFLS	ALAEYTKKLNTQ
P02647	GLLPVLESFKVSFLS	ALAEYTKKLNTQ
AAA51747	GLLPVLESFKVSFLS	ALAEYTKKLNTQ
CAA00975	GLLPVLESFKVSFLS	ALAEYTKKLNTQ
CAA03490	GLLPVLESFKVSFLS	ALAEYTKKLNTQ
P15568	GLLPVLESFKVSFLS	ALAEYTKKLNTQ

[illegible]

<b>Sequences producing High- scoring Segment Pairs</b>	<b>Protein/Organism</b>	<b>Length (aa)</b>	<b>Identity (%)</b>	<b>Positive (%)</b>	<b>E Value</b>
patp:AAP61079	Assumed human apolipoprotein A-1 derivative gene product - Homo sapiens	267	193/193 (100%)	193/193 (100%)	7.3e-98
patp:AAP82128	Entire human preproapoprotein A1 - synthetic	267	193/193 (100%)	193/193 (100%)	7.3e-98
patp:AAR34032	Sequence of apo AI - Homo sapiens	267	193/193 (100%)	193/193 (100%)	7.3e-98
patp:AAR72705	Human apo A-I including signal and propeptide sequences - Homo sapiens	267	193/193 (100%)	193/193 (100%)	7.3e-98
patp:AAY18675	Human apolipoprotein AI protein sequence - Homo sapiens	267	193/193 (100%)	193/193 (100%)	7.3e-98

5

**Table 17F. Domain Analysis of NOV17**

**Pfam analysis**

Model	Domain	seq-f	seq-t	hmm-f	hmm-t	score	E-value
KMP11	1/1	38	130 ..	1	90 []	-6.7	7.5
Apolipoprotein	1/1	2	238 ..	1	277 []	376.2	3.3e-109

**Alignments of top-scoring domains:**

KMP11: domain 1 of 1, from 38 to 130: score -6.7, E = 7.5  
(SEQ ID NO:224)

NOV17      38      LATVYVDVLK--DSVTSTFS-KLREQlgpVTQEFWDNLEKETegLRQ    81

EmKEHYEKFEkmiqEHtdKFnKKmrEHSEHFKgKFAEL.LEqqKnAgyP<  
||                 +|       | || +|       ++||       + |       +       +++  
82 EMSKDLEEVEKAKVQPYLDDFQKKWQEEMELYRQKVEPLrAELQEGARQK    130

Apolipoprotein: domain 1 of 1, from 2 to 238: score 376.2, E = 3.3e-109  
(SEQ ID NO:225)

NOV17      2      KAAVLTLAVLFLTGSQARHFQQDEPP-----QSPWDRVKDLATV    41

YlrqVkdssdqaveqLessqvqtqeLnllLednlldelksyaeeLgeqLgPv  
++ +|||                                         + |+++++|+|||||  
42 YVDVLKDS-----VTSTFSKLREQLGVP    64

aqefgarLsKetgalraelgkDlEdvrnrLaPyrdEvqamlgqnleeyRq  
+|||+++|+|||+ ||+|+ |||||+\*\*\*\*\*|+|++|\*\*\*\*\*| |||  
65 TQEFWDNLEKETEGRLQEQMSKDLEEVEKAKVQPYLDDFQKKWQEEMELYRQ    114

rLePlareLrkrlrrdaeeLgkrLaPyaeelReraernVdalrerLgPyv  
++||| +|+\*\*\*\*+\*\*\*\*\*||++|+\*\*|+|+|+++|||++|+|+

```

115 KVEPLRAELQEGARQKLHELQEKLSPLGEEMRDRARAHVDALRTHLAPYS 164

EqlRqkaAtlltqrleeLrEraqpypaeEykeqleeqlselReklapvred
++|||+      ++|||+|+|++ ++++|++++|+||+| ||++|++||
165 DELRQR---LAARLEALKENG GARLA EYHAKATEHLSTLSEKAKPALED 210

lqevltpvlEqaQklqaeafqeelkkkle<-*
|+++| |||+ +|++++++||+ |||+
211 LRQGLLPVLES--FKVSFLSALEEYTKKLN      238

```

The apolipoprotein A-I disclosed in this invention is expressed in at least the following tissues: adrenal gland, bone marrow, brain - amygdala, brain - cerebellum, brain - hippocampus, brain - substantia nigra, brain - thalamus, brain -whole, fetal brain, fetal kidney, fetal liver, fetal lung, heart, kidney, lymphoma - Raji, mammary gland, pancreas, pituitary gland, placenta, prostate, salivary gland, skeletal muscle, small intestine, spinal cord, spleen, stomach, testis, thyroid, trachea, uterus, Colon, Gall Bladder, Liver, Lung, Lymph node, Lymphoid tissue, Ovary, Spleen, Thymus, Whole Organism. This information was derived by determining the tissue sources of the sequences that were included in the invention including but not limited to SeqCalling sources, Public EST sources, literature sources, and/or RACE sources.

In addition, the sequence is predicted to be expressed in liver because of the expression pattern of (GENBANK-ID: gb:GENBANK-ID:HUMAPOAIB|acc:M27875.1) a closely related Human apolipoprotein A-I mRNA, complete cds homolog in species Homo sapiens.

5 The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies. For example, the compositions of the present invention may have efficacy for treatment of patients suffering from: atherosclerosis, coronary artery disease, other arterial diseases and other diseases, disorders and conditions of the like. The structure of Tangier APOA-I, which fails to associate with HDL, corresponds to that of PRO-APOA-I. This  
10 suggests that a faulty conversion of the precursor molecule is responsible for its formation. Tangier disease is characterized by an absence of plasma HDL and accumulation of cholesteryl esters. Milano variant patients have variable amounts of normal versus variant APOA-I, decreased concentrations of HDL, and moderate increases in triglycerides, but no evidence of premature vascular disease. A sequence variant has been identified in amyloid  
15 fibrils from patients with polyneuropathic amyloidosis type III (FAP III): the Iowa type variant. Variant ARG-84 causes autosomal dominant amyloidosis. Defects in APOA1 can be the cause of hereditary non-neuropathic systemic amyloidosis (Ostertag-type).

The inverse relationship between high density lipoprotein (HDL) plasma levels and coronary heart disease has been attributed to the role that HDL and its major constituent,  
20 apolipoprotein A-I (apoA-I), play in reverse cholesterol transport (RCT). The efficiency of RCT depends on the specific ability of apoA-I to promote cellular cholesterol efflux, bind lipids, activate lecithin:cholesterol acyltransferase (LCAT), and form mature HDL that interact with specific receptors and lipid transfer proteins. From the intensive analysis of apoA-I secondary structure has emerged our current understanding of its different classes of  
25 amphipathic alpha-helices, which control lipid-binding specificity. Two models are considered for discoidal lipoproteins formed by association of two apoA-I with phospholipids. In the first or picket fence model, each apoA-I wraps around the disc with antiparallel adjacent alpha-helices and with little intermolecular interactions. In the second or belt model, two antiparallel apoA-I are paired by their C-terminal alpha-helices, wrap around the lipoprotein,  
30 and are stabilized by multiple intermolecular interactions. While recent evidence supports the belt model, other models, including hybrid models, cannot be excluded. ApoA-I alpha-helices control lipid binding and association with varying levels of lipids. The N-terminal helix 44-65 and the C-terminal helix 210-241 are recognized as important for the initial association with



lipids. In the central domain, helix 100-121 and, to a lesser extent, helix 122-143, are also very important for lipid binding and the formation of mature HDL, whereas helices between residues 144 and 186 contribute little. The LCAT activation domain has now been clearly assigned to helix 144-165 with secondary contribution by helix 166-186. The lower lipid binding affinity of the region 144-186 may be important to the activation mechanism allowing displacement of these apoA-I helices by LCAT and presentation of the lipid substrates. No specific sequence has been found that affects diffusional efflux to lipid-bound apoA-I. In contrast, the C-terminal helices, known to be important for lipid binding and maintenance of HDL in circulation, are also involved in the interaction of lipid-free apoA-I with macrophages and specific lipid efflux. Epidemiological and clinical studies showing an association between decreased concentrations of high-density lipoprotein (HDL) cholesterol and increased risk of premature coronary artery disease have generated interest in the mechanism through which HDL prevents atherosclerosis. Recognition of the importance of apolipoproteins (apo(s)) has led to the separation of HDL into subpopulations according to their apolipoprotein composition. It is now recognised that HDL comprises at least two types of apo A-I-containing lipoproteins: LpA-I:A-II containing both apo A-I and apo A-II and LpA-I containing apo A-I but not apo A-II. A majority of studies support the fact that LpA-I is more effective than LpA-I:A-II in promoting cellular cholesterol efflux, the first step in reverse cholesterol transport. Studies in transgenic animals have revealed that the gene transfer of human apo A-I in mice and rabbits increases plasma apo A-I and HDL cholesterol levels and particularly apo A-I-rich HDL particle concentrations, leading to inhibition of the development of dietary or genetically induced atherosclerosis. On the other hand, gene transfer of apo A-II in mice gives conflicting results. The conclusions of some experiments indicate either an atherogenic, or a poorly anti-atherogenic, or even a strongly anti-atherogenic role for apo A-II and for apo A-II-rich HDL lipoproteins. Although these experimental results have been obtained in animals, they confirm previous studies obtained in human clinical studies, indicating that apo A-I-rich HDL (tested as LpA-I in clinical studies) are generally strong plasma markers of atherosclerosis protection while the clinical significance of apo A-I + apo A-II HDL (tested as LpA-I:A-II in clinical studies) is more controversial. Over the past few years, new experimental approaches have reinforced the awareness among investigators that the heterogeneity of HDL particles indicates significant differences in production and catabolism of HDL particles. Recent kinetic studies have suggested that small HDL, containing two apolipoprotein A-I molecules per particle, are converted in a unidirectional manner to medium HDL or large HDL, containing three or four apolipoprotein A-I molecules

per particle, respectively. Conversion appears to occur in close physical proximity with cells and not while HDL particles circulate in plasma. The medium and large HDL are terminal particles in HDL metabolism with large HDL, and perhaps medium HDL, being catabolized primarily by the liver. These kinetic studies of HDL subfraction metabolism are compelling in-vivo data that are consistent with the proposed role of HDL in reverse cholesterol transport. The protein components of human lipoproteins, apolipoproteins, allow the redistribution of cholesterol from the arterial wall to other tissues and exert beneficial effects on systems involved in the development of arterial lesions, like inflammation and hemostasis. Because of these properties, the antiatherogenic apolipoproteins, particularly apo A-I and apo E, may provide an innovative approach to the management of vascular diseases. The recent availability of extractive or biosynthetic molecules is allowing a detailed overview of their therapeutic potential in a number of animal models of arterial disease. Infusions of apo E, or more dramatically, of apo A-I, both recombinant or extractive, cause a direct reduction of the atherosclerotic burden in experimental animals. Naturally, as the apo A-I(Milano) (apo A-I(M)) dimer, or engineered recombinant apolipoproteins with prolonged permanence in plasma and improved function may offer an even better approach to the therapeutic handling of arterial disease. This progress will go on in parallel with innovations in the technologies for direct, non invasive assessments of human atherosclerosis, thus allowing closer monitoring of this potential new approach to therapy.

## NOV18

A disclosed NOV18 nucleic acid of 751 nucleotides (also referred to as CG56747-02) (SEQ ID NO:55) encoding a novel Apolipoprotein A-1 Precursor-like protein is shown in Table18A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 87-89 and ending with a TGA codon at nucleotides 708-710. Putative untranslated regions are found upstream from the initiation codon and downstream from the termination codon, and are underlined. The start and stop codons are in bold in Table 18A.

**Table 18A. NOV18 nucleotide sequence (SEQ ID NO:55)**

<p>GAATTCAAAAAAAAAAGAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAGAGAGACTGCGAG  AAGGAGGTCCCCACGGCCCTCAGGATGAAAGCTGCGGTGCTGACCTTGGCCGTGCTCT  TCCTGACGGGGAGCCAGGCTCGGCATTTCTGGCAGCAAGATGAACCCCCCAGAGCCCCCT  GGGATCGAGTGAAGGACCTGGCCACTGTGTACGTGGATGTGCTCAAGGACAGCGTGACCT  CCACCTTCAGCAAGCTGCGCGAACAGCTCGGCCCTGTGACCCAGGAGTTCTGGGATAACC  TGGAAAAGGAGACAGAGGGCCTGAGGCAGGAGATGAGCAAGGATCTGGAGGAGGTGAAGG  CCAAGGTGCAGCCCTACCTGGACGACTTCCAGAAGAAGTGGCAGGAGGAGATGGAGCTCT  ACCGCCAGAAGGTGGAGCCGCTGCGCGCAGAGCTCCAAGAGGGCGCGCCAGAAGCTGC  ACGAGCTGCGCCAGCGCTTGGCCGAGCGCCTTGGAGCTCTCAAGGAGAACGGCGGCGCCA</p>
--

GACTGGCCGAGTACCACGCCAAGGCCACCGAGCATCTGAGCACGCTCAGCGAGAAGGCCA  
AGCCCGCGCTCGAGGACCTCCGCCAAGGCCTGCTGCCGTGCTGGAGAGCTTCAAGGTCA  
GCTTCCTGAGCGCTCTCGAGGAGTACACTAAGAAGCTCAACACCCAGTGAGGCGCCCGCC  
GCCGCCCCCTTCCCGGTGCTCAGAATAAAC

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 424 of 521 bases (81%) identical to a gb:GENBANK-ID: HSAPOAIT|acc:X07496.1 mRNA from Homo sapiens (Human Tangier apoA-I gene).

A disclosed NOV18 polypeptide (SEQ ID NO:56) encoded by SEQ ID NO:55 has 207 amino acid residues and is presented in Table 18B using the one-letter code. NOV18 polypeptides are likely Type IIb (Nexo Cyt) membrane proteins. The SignalP, Psort and/or Hydropathy results predict that NOV18 has a signal peptide and is likely to be localized extracellularly with a certainty of 0.3700. In an alternative embodiment, NOV18 is likely to be localized to the microbody (peroxisome) with a certainty of 0.1129, or to the endoplasmic reticulum membrane with a certainty of 0.1000, or to the endoplasmic reticulum (lumen) with a certainty of 0.1000. The signal peptide is predicted by SignalP to be cleaved between amino acids 18 and 19, i.e., at the dash in the sequence SQA-RH.

**Table 18B. NOV18 protein sequence (SEQ ID NO:56)**

MKA AVLTLAVLFLTGSQARHFWQQDEPPQSPWDRVKDLATVYVDVLKDSVTSTFSKLREQ  
LGPVTQEFWDNLEKETEGRLQEMSKDLEEVKAKVQPYLDDFQKKWQEEEMELYRQKVEPLR  
AELQEGARQKLHELRLRLAERLEALKENGARLA EYHAKATEHLSTLSEKAKPALEDLRQ  
GLLPVLESFKVSFLSALEEYTKKLNTQ

NOV18 is an internal splice variant of the previously identified sequence NOV17 (Accession Number CG55982-01). The relationship between the NOV17 and NOV18 protein sequences is shown in Table 18C.

**Table 18C. ClustalW Alignment of NOV17 and NOV18**

	10	20	30	40	50	60	70	80
CG55982_01	.....	.....	.....	.....	.....	.....	.....	.....
CG56747_02	.....	.....	.....	.....	.....	.....	.....	.....
	90	100	110	120	130	140	150	160
CG55982_01	.....	.....	.....	.....	.....	.....	.....	.....
CG56747_02	.....	.....	.....	.....	.....	.....	.....	.....
	170	180	190	200	210	220	230	240
CG55982_01	.....	.....	.....	.....	.....	.....	.....	.....
CG56747_02	.....	.....	.....	.....	.....	.....	.....	.....



	170	180	190	200	210	220	230	240
NOV18	.....RQRLAERLEALKENG GARLA EYHAKATEHLSTLSEKAKPALEDLRQ							
P02647	LQEKLSPLGGEEMRDRARAHVDALRTHLAPYSDELQRQLAARLEALKENG GARLA EYHAKATEHLSTLSEKAKPALEDLRQ							
AAA51747	LQEKLSPLGGEEMRDRARAHVDALRTHLAPYSDELQRQLAARLEALKENG GARLA EYHAKATEHLSTLSEKAKPALEDLRQ							
CAA00975	LQEKLSPLGGEEMRDRARAHVDALRTHLAPYSDELQRQLAARLEALKENG GARLA EYHAKATEHLSTLSEKAKPALEDLRQ							
CAA03490	LQEKLSPLGGEEMRDRARAHVDALRTHLAPYSDELQRQLAARLEALKENG GARLA EYHAKATEHLSTLSEKAKPALEDLRQ							
P15568	LQEKLSPLGGEEMRDRARAHVDALRTHLAPYSDELQRQLAARLEALKENG GARLA EYHAKATEHLSTLSEKAKPALEDLRQ							
	250	260						
NOV18	.....GLLPVLESFKVSFLSALEEYTKKLNTQ							
P02647	.....GLLPVLESFKVSFLSALEEYTKKLNTQ							
AAA51747	.....GLLPVLESFKVSFLSALEEYTKKLNTQ							
CAA00975	.....GLLPVLESFKVSFLSALEEYTKKLNTQ							
CAA03490	.....GLLPVLESFKVSFLSALEEYTKKLNTQ							
P15568	.....GLLPVLESFKVSFLSALEEYTKKLNTQ							

Other BLAST results include sequences from the Patp database, which is a proprietary database that contains sequences published in patents and patent publications. Patp results include those listed in Table 18F.

**Table 18F. Patp BLASTP Analysis for NOV18**

Sequences producing High-scoring Segment Pairs	Protein/Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAP61079	Assumed human apolipoprotein A-1 derivative gene product - Homo sapiens	267	104/156 (66%)	118/156 (75%)	3.0e-46
patp:AAP82128	Entire human preproapoprotein A1 - synthetic	267	104/156 (66%)	118/156 (75%)	3.0e-46
patp:AAR34032	Sequence of apo AI - Homo sapiens	267	104/156 (66%)	118/156 (75%)	3.0e-46
patp:AAR72705	Human apo A-I including signal and propeptide sequences - Homo sapiens	267	104/156 (66%)	118/156 (75%)	3.0e-46
patp:AAY18675	Human apolipoprotein AI protein sequence - Homo sapiens	267	104/156 (66%)	118/156 (75%)	3.0e-46

5 Table 18G lists the domain description from DOMAIN analysis results against NOV18.

**Table 18G. Domain Analysis of NOV18**

Table 18G. Domain Analysis of NOV18									
Pfam analysis									
Model	Domain	seq-f	seq-t		hmm-f	hmm-t	score	E-value	
-----	-----	-----	-----		-----	-----	-----	-----	
KMP11	1/1	38	130	..	1	90 []	-6.7	7.5	
Apolipoprotein	1/1	2	205	..	1	277 []	256.2	4.4e-73	
Alignments of top-scoring domains:									
KMP11: domain 1 of 1, from 38 to 130: score -6.7, E = 7.5									
(SEQ ID NO:231)		mAttyEeFaaKLDRLDeEFnkKmeEq...nakFFADKPDest..LsP							
		+      +   +    ++   ++ +     +  ++							
NOV18	38	LATVYVDVLK--DSVTSTFS-KLREQlgpVTQEFWDNLEKETegLRQ 81							

```

EmKEHYEKFekmiegEHtDKFnKKMrEHSEHFkQKFAEL.LEqqKnAgyP<
||      |    +|   ||   |+|   ++||     + |   | 
82 EMSKDLEEVKAkvQPYLDDFQKKWQEEMELYRQKVPELrAEQLQEGARQK 130

Apolipoprotein: domain 1 of 1, from 2 to 205: score 256.2, E = 4.4e-73
(SEQ ID NO:232)           KalvlaLalllLtGcqaArsfwQadePEvtegaWqqsqwdgvkdfrfvw
                           ||+||++||+||+||||+||||+         ||+||+||||+++|
NOV18          2       KAAVLTLAVLF LTGSQA RHFWQQDEPP----- QSPWD RVDLATV 41

YlrqVkdssdqavegLessqvqtqeLnllLednldelksyaeeLgeqLgPv
|++ +||              + ++++|+|||||
42 YVDVLKDS-----VTSTFSKLREQLGPV 64

aqefgarLSketgalraelgkDlEdvrnrLaPyrdEvqamlggnleeyRq
+||||+++|++++| ++|+ |||+|+++++|++|+++|+++++| |||
65 TQEFWDNLEKETEGLRQEMS KDLEE VKAKVPYLD DDFQKKW QEEMELYRQ 114

rLePlareLrkrlrrdaeeLqkrLaPyaeelReraernVdalrerLgPyv
++||| +|++++|++++|
115 KVEPLRAELQEGARQKLHEL----- 134

EqLRgkaAtllltqrleeLrEraqpypayEykegleeqglsselReklaprvred
||+   +-+|||++|++|++++|++++|+||+| |++|++|
135 ---RQR---LAERLEALKENG GAR LAEYH AKATEHL STL SEKAKPALED 177

lgevltptvlEqaqlklgaeafgeelkkkle-*
|+++| |||+ +|+++++|++| |||+
178 LRQG LLPVLES--FKVSFLSAL EEYT KKLN        205
```

**IPR000074:** Human apolipoprotein E, a blood plasma protein, mediates the transport and uptake of cholesterol and lipid by way of its high affinity interaction with different cellular receptors, including the low-density lipoprotein (LDL) receptor. The three-dimensional structure of the LDL receptor-binding domain of apoE indicates that the protein forms an unusually elongated four-helix bundle that may be stabilized by a tightly packed hydrophobic core that includes leucine zipper-type interactions and by numerous salt bridges on the mostly charged surface. Basic amino acids important for LDL receptor binding are clustered into a surface patch on one long helix.

The sequence is predicted to be expressed in the following tissues because of the expression pattern of (GENBANK-ID: gb:GENBANK-ID:HSAPOAIT|acc:X07496.1) a closely related Human Tangier apoA-I gene homolog in species Homo sapiens :lymphocyte.

The nucleic acids and proteins of the invention have applications in the diagnosis and/or treatment of various diseases and disorders. For example, the compositions of the present invention will have efficacy for the treatment of patients suffering from: dysbetalipoproteinemia, hyperlipoproteinemia type III, atherosclerosis, xanthomatosis and premature coronary and/or peripheral vascular disease, hypothyroidism, systemic lupus erythematosus, diabetic acidosis, hypercholesterolemia, planar and tendon xanthomas, dysbetalipoproteinemia, hypercholesterolemia, premature cardiovascular disease, accelerated

vascular disease, Alzheimer Disease, familial amyloidotic polyneuropathy, Down syndrome and other neurological disorders as well as other diseases, disorders and conditions.

Utermann et al. (Clin. Genet. 15: 63-72,1979) described 2 phenotypes, apoE(IV+) and apoE(IV-), differentiated by analytical isoelectric focusing. They concluded that this polymorphism of apolipoprotein E in human serum is determined by 2 autosomal codominant alleles, apoE(n) and apoE(d). Homozygosity for the latter results in primary dysbetalipoproteinemia but only some persons develop gross hyperlipidemia (hyperlipoproteinemia type III). Vertical transmission is pseudodominance due to high frequency of the apoE(d) gene (Utermann et al., 1979). Dysbetalipoproteinemia is already expressed in childhood. They concluded that primary dysbetalipoproteinemia is a frequent monogenic variant of lipoprotein metabolism, but not a disease. Coincidence of the genes for this dyslipoproteinemia with any of the genes for monogenic or polygenic forms of familial hyperlipemia results in hyperlipoproteinemia type III. Further complexities of the genetics of the apolipoprotein E system were discussed by Utermann et al. (Am. J. Hum. Genet. 32: 339-347,1980). Apolipoprotein E (apoE) of very low density lipoprotein (VLDL) from different persons shows 1 of 2 complex patterns, termed alpha and beta (Zannis et al., 1981). Three subclasses of each pattern were found and designated alpha-II, alpha-III and alpha-IV and beta-II, beta-III and beta-IV. From family studies, Zannis et al. (Am. J. Hum. Genet. 33: 11-24, 1981) concluded that a single locus with 3 common alleles is responsible for these patterns. The alleles were designated epsilon-II, -III, and-IV. The authors further concluded that beta class phenotypes represent homozygosity for one of the epsilon alleles, e.g., beta-II results from homozygosity for the epsilon-II allele. In contrast, the alpha phenotypes are thought to represent compound heterozygosity, i.e., heterozygosity for 2 different epsilon alleles: alpha II from epsilon II and III; alpha III from epsilon III and IV. The frequency of the epsilon II, III, and IV alleles was estimated at 0.11, 0.72, and 0.17, respectively. ApoE subclass beta-IV was found to be associated with type III hyperlipoproteinemia. Rall et al. (J. Biol. Chem. 257: 4171-4178,1982) published the full amino acid sequence. Mature apoE is a 299-amino acid polypeptide.

The 3 major isoforms of human apolipoprotein E (apoE2, -E3, and -E4), as identified by isoelectric focusing, are coded for by 3 alleles (epsilon 2, 3, and 4). The E2 (107741.0001), E3 (107741.0015), and E4 (107741.0016) isoforms differ in amino acid sequence at 2 sites, residue 112 (called site A) and residue 158 (called site B). At sites A/B, apoE2, -E3, and -E4 contain cysteine/cysteine, cysteine/arginine, and arginine/arginine, respectively (Weisgraber et al., J. Biol. Chem. 256: 9077-9083,1981; Rall et al., Proc. Nat. Acad. Sci. 79: 4696-4700,

1982). The 3 forms have 0, 1+, and 2+ charges to account for electrophoretic differences (Margolis, 1982). (The nomenclature of the apolipoprotein E isoforms, defined by isoelectric focusing, has gone through an evolution.) E3 is the most frequent ('wildtype') isoform. As reviewed by Smit et al. (J. Lipid Res. 31: 45-53,1990), E4 differs from E3 by a cys-to-arg  
5 change at position 112 and is designated E4(cys112-to-arg). Four different mutations giving a band at the E2 position with isoelectric focusing have been described: E2(arg158-to-cys), E2(lys146-to-gln), E2(arg145-to-cys) and E2-Christchurch(arg136-to-ser). E2(arg158-to-cys) is the most common of the 4.

In a comprehensive review of apoE variants, de Knijff et al. (Clin. Invest. 88: 643-  
10 655,1994) found that 30 variants had been characterized, including the most common variant, apoE3. To that time, 14 apoE variants had been found to be associated with familial dysbetalipoproteinemia, characterized by elevated plasma cholesterol and triglyceride levels and an increased risk for atherosclerosis.

Data on gene frequencies of apoE allelic variants were tabulated by Roychoudhury and  
15 Nei (New York: Oxford Univ. Press (pub.) 1988). Gerdes et al. (Genet. Epidemiol. 9:155-167,1992) and Gerdes et al. (Hum. Genet. 98: 546-550,1996) reported the frequency of apoE polymorphisms in the Danish population and in Greenland Inuit, respectively, in relation to the findings in 45 other study populations around the world.

In normal individuals, chylomicron remnants and very low density lipoprotein (VLDL)  
20 remnants are rapidly removed from the circulation by receptor-mediated endocytosis in the liver. In familial dysbetalipoproteinemia, or type III hyperlipoproteinemia (HLP III), increased plasma cholesterol and triglycerides are the consequence of impaired clearance of chylomicron and VLDL remnants because of a defect in apolipoprotein E. Accumulation of the remnants can result in xanthomatosis and premature coronary and/or peripheral vascular disease.

Hyperlipoproteinemia III can be either due to primary heritable defects in apolipoprotein  
25 metabolism or secondary to other conditions such as hypothyroidism, systemic lupus erythematosus, or diabetic acidosis. Most patients with familial dysbetalipoproteinemia (HLP III) are homozygous for the E2 isoform (J. Lipid Res. 23: 1224-1235, Breslow et al., 1982). Only rarely does the disorder occur with the heterozygous phenotypes E3E2 or E4E2. The E2  
30 isoform shows defective binding of remnants to hepatic lipoprotein receptors (Schneider et al., J. Clin. Invest. 68: 1075-1085, 1981; Rall et al., Proc. Nat. Acad. Sci. 79: 4696-4700, 1982) and delayed clearance from plasma (Gregg et al., Science 211: 584-586, 1981). Additional genetic and/or environmental factors must be required for development of the disorder, however, because only 1-4% of E2E2 homozygotes develop familial dysbetalipoproteinemia.



Since the defect in this disorder involves the exogenous cholesterol transport system, the degree of hypercholesterolemia is sensitive to the level of cholesterol in the diet (Brown et al., Science 212: 628-635, 1981). Even on a normal diet, the patient may show increased plasma cholesterol and the presence of an abnormal lipoprotein called beta-VLDL. VLDL in general is markedly increased while LDL is reduced.

Carbohydrate induces or exacerbates the hyperlipidemia, resulting in marked variability in plasma levels and ready therapy through dietary means. Often tuberous and planar and sometimes tendon xanthomas occur as well as precocious atherosclerosis and abnormal glucose tolerance. Tuberous and tuberoeruptive xanthomas are particularly characteristic. Hazzard (1978) demonstrated the eliciting effects of electric shock in a man revived from accidental electrocution and later showing striking xanthomas of the palms. Development of the phenotype is age dependent, being rarely evident before the third decade. The nosography of the type III hyperlipoproteinemia phenotype up to 1977 was reviewed by Levy and Morganroth (Ann. Intern. Med. 87: 625-628, 1977). Subsequent description of specific biochemical alterations in apolipoprotein structure and metabolism has proven this phenotype to be genetically heterogeneous. In the first application of apoprotein immunoassay to this group of disorders, Kushwaha et al. (Ann. Intern. Med. 87: 517-525, 1977) found that apolipoprotein E (arginine-rich lipoprotein) is high in the VLD lipoproteins of type III. They also found that exogenous estrogen, which stimulates triglyceride production in normal women and those with endogenous hypertriglyceridemia, exerted a paradoxical hypotriglyceridemic effect in this disorder (Kushwaha et al., 1977). The abnormal pattern of apoE by isoelectric focusing (IEF), specifically, the absence of apoE3, is the most characteristic biochemical feature of HLP III. Gregg et al. (1981) showed that apoE isolated from subjects with type III HLP had a decreased fractional catabolic rate in vivo in both type III HLP patients and normal persons.

Hazzard et al. (Metabolism 30: 79-88, 1981) reported on the large O'Donnell kindred, studied because of a proband with type III HLP. They studied specifically the VLDL isoapolipoprotein E distributions. The findings confirmed earlier work indicating that the ratio of E3 to E2 is determined by two apoE3 alleles, designated d and n, which produce three phenotypes, apoE3-d, apoE3-nd, and apoE3-n, corresponding to the low, intermediate, and high ratios. Ghiselli et al. (Science 214: 1239-1241, 1981) studied a black kindred with type III HLP due to deficiency of apolipoprotein E. No plasma apolipoprotein E could be detected. Other families with type III HLP have had increased amounts of an abnormal apoE. In addition, the patients of Ghiselli et al. (1981) had only mild hypertriglyceridemia, increased

LDL cholesterol, and a much higher ratio of VLDL cholesterol to plasma triglyceride than reported in other type III HLP families. The proband was a 60-year-old woman with a 10-year history of tuberoeruptive xanthomas of the elbows and knees, a 3-year history of angina pectoris, and 80% narrowing of the first diagonal coronary artery by arteriography. Her father had xanthomas and died at age 62 of myocardial infarction. Her mother was alive and well at age 86. Three of 7 sibs also had xanthomas; her 2 offspring had no xanthomas. The evidence suggests that apoE is important for the catabolism of chylomicron fragments. The affected persons in the family studied by Ghiselli et al. (1981) had plasma levels of apoE less than 0.05 mg/dl by radioimmunoassay, and no structural variants of apoE were detected by immunoblot of plasma or VLDL separated by 2-dimensional gel electrophoresis. Anchors et al. (Biochem. Biophys. Res. Commun. 134: 937-943, 1986) reported that the apoE gene was present in the apoE-deficient patient and that there were no major insertions or deletions in the gene by Southern blot analysis. Blood monocyte-macrophages isolated from a patient contained levels of apoE mRNA 1 to 3% of that present in monocyte-macrophages isolated from normal subjects. The mRNA from the patient appeared to be of normal size. Anchors et al. (1986) suggested that the decreased apoE mRNA might be due to a defect in transcription or processing of the primary transcript or to instability of the apoE mRNA. The decreased plasma level of apoE resulted in delayed clearance of remnants of triglyceride-rich lipoproteins, hyperlipidemia, and the phenotype of type III HLP. In the kindred with apolipoprotein E deficiency studied by Ghiselli et al. (1981), the defect was shown by Cladaras et al. (J. Biol. Chem. 262: 2310-2315, 1987) to involve an acceptor splice site mutation in intron 3 of the APOE gene (107741.0005). ApoE, a main apoprotein of the chylomicron, binds to a specific receptor on liver cells and peripheral cells. The E2 variant binds less readily. A defect in the receptor for apoE on liver and peripheral cells might also lead to dysbetalipoproteinemia, but such has not been observed. Weisgraber et al. (Biol. Chem. 257: 2518-2521, 1982) showed that human E apoprotein of the E2 form, which contains cysteine (rather than arginine) at both of the 2 variable sites, binds poorly with cell surface receptors, whereas E3 and E4 bind well. They postulated that a positively charged residue at variable site B is important for normal binding. To test the hypothesis, they treated E2 apoE with cysteamine to convert cysteine to a positively charged lysine analog. This resulted in a marked increase in the binding activity of the E2 apoE. Although nearly every type III hyperlipoproteinemic person has the E2/E2 phenotype, 95 to 99% of persons with this phenotype do not have type III HLP nor do they have elevated plasma cholesterol levels. Rall et al. (J. Clin. Invest. 72: 1288-1297, 1983) showed that apoE2 of hypo-, normo-, and hypercholesterolemic subjects showed the same

severe functional abnormalities. Thus, factors in addition to the defective receptor binding activity of the apoE2 are necessary for manifestation of type III HLP. A variety of factors exacerbate or modulate type III. In women, it most often occurs after the menopause and in such patients is particularly sensitive to estrogen therapy. Hypothyroidism exacerbates type III and thyroid hormone is known to enhance receptor-mediated lipoprotein metabolism. Obesity, diabetes and age are associated with increased hepatic synthesis of VLDL and/or cholesterol; occurrence of type III in E2/E2 persons with these factors may be explained thereby. Furthermore, the defect in familial combined HLP (144250), which is, it seems, combined with E2/E2 in the production of type III (Utermann et al., 1979; Hazzard et al., 1981), may be hepatic overproduction of cholesterol and VLDL. As pointed out by Brown and Goldstein (J. Clin. Invest. 72: 743-747, 1983), familial hypercholesterolemia (FH) is a genetic defect of the LDL receptor (LDLR; 143890), whereas familial dysbetalipoproteinemia is a genetic defect in a ligand. The puzzle that all apoE2/2 homozygotes do not have extremely high plasma levels of IDL and chylomicron remnants (apoE-containing lipoproteins) may be solved by the observation that the lipoprotein levels in these patients are exquisitely sensitive to factors that reduce hepatic LDL receptors, e.g., age, decreased levels of thyroid hormone and estrogen, and the genetic defect of FH. Presumably, high levels of hepatic LDL receptors can compensate for the genetic binding defect of E2 homozygotes. Gregg et al. (Lancet I: 353, 1983) suggested that apoE4 is associated with severe type V hyperlipoproteinemia in a manner comparable to the association of apoE2 with type III. Vogel et al. (Proc. Nat. Acad. Sci. 82: 8696-8700, 1985) showed that large amounts of apoE can be produced by E. coli transformed with a plasmid containing a human apoE cDNA. The use in studies of structure-function relationships through production of site-specific mutants was noted. Wardell et al. (J. Biol. Chem. 264: 21205-21210, 1989) demonstrated that the defect is a 7-amino acid insertion that represents a tandem repeat of amino acid residues 121-127 resulting in the normal protein having 306 amino acids rather than the normal 299. Schaefer et al. (J. Clin. Invest. 78: 1206-1219, 1986) described a unique American black kindred with premature cardiovascular disease, tuberoeruptive xanthomas, and type III HLP associated with familial apolipoprotein E deficiency. Four homozygotes had marked increases in cholesterol-rich, very low density lipoproteins and intermediate density lipoproteins (IDL). Homozygotes had only trace amounts of plasma apoE, and accumulations of apoB-48 (107730) and apoA-4 (107690) in VLDL, IDL, and low density lipoproteins. Obligate heterozygotes generally had normal plasma lipids and mean plasma apoE concentrations that were 42% of normal. The findings indicated that apoE is essential for the normal catabolism of triglyceride-rich lipoprotein

constituents. It had been shown that cultured peripheral blood monocytes synthesized low amounts of 2 aberrant forms of apoE mRNA but produced no immunoprecipitable forms of apoE. The expression studies were done comparing the normal and abnormal APOE genes transfected into mouse cells in combination with the mouse metallothionein I promoter. Bersot et al. (J. Clin. Invest. 72: 1024-1033,1983) studied atypical dysbetalipoproteinemia characterized by severe hypercholesterolemia and hypertriglyceridemia, xanthomatosis, premature vascular disease, the apoE3/3 phenotype (rather than the classic E2/2 phenotype), and a preponderance of beta-VLDL. They showed that the beta-VLDL from these subjects stimulated cholesteryl ester accumulation in mouse peritoneal macrophages. They suggested that the accelerated vascular disease results from this uptake by macrophages which are converted into the foam cells of atherosclerotic lesions. Smit et al. (Clin. Genet. 32: 335-341,1987) described 3 out of 41 Dutch dysbetalipoproteinemic patients who were apparent E3/E2 heterozygotes rather than the usual E2/E2 homozygotes. All 3 genetically unrelated patients showed an uncommon E2 allele that contained only 1 cysteine residue. The uncommon allele cosegregated with familial dysbetalipoproteinemia which in these families seemed to behave as a dominant. Smit et al. (1990) showed that these 3 unrelated patients had E2(lys146-to-gln). Eto et al. (Clin. Genet. 36: 183-188,1989) presented data from Japan indicating that both the E2 allele and the E4 allele are associated with an increased risk of ischemic heart disease as compared with the E3 allele. Boerwinkle and Utermann (Am. J. Hum. Genet. 42: 104-112,1988) studied the simultaneous effect of apolipoprotein E polymorphism on apolipoprotein E, apolipoprotein B, and cholesterol metabolism. Since both apoB and apoE bind to the LDL receptor and since the different isoforms show different binding affinity, these effects are not unexpected. Subjects with typical dysbetalipoproteinemia are homozygous for an amino acid substitution in apoE at residue 158 (107741.0001). Chappell (. Clin. Invest. 84: 1906-1915,1989) studied the binding properties of lipoproteins in 9 subjects with dysbetalipoproteinemia who were either homozygous or heterozygous for substitutions at atypical sites: at residue 142 in 6, at 145 in 2, and at 146 in 1. In 5 of 19 Australian men, aged 30 to 50, who were referred for coronary angioplasty (26%), van Bockxmeer and Mamotte (Lancet 340: 879-880,1992) observed homozygosity for E4. This represented a 16-fold increase compared with controls. Payne et al. (Lancet 340: 1350,1992), O'Malley and Illingworth (Lancet 340: 1350-1351,1992), and de Knijff et al. (Lancet 340: 1350-1351,1992) expressed doubts concerning a relationship between E4 and atherosclerosis. Feussner et al. (Am. J. Med. Genet. 65: 149-154,1996) reported a 20-year-old man with a combination of type III hyperlipoproteinemia and heterozygous familial

hypercholesterolemia (FH;143890). Multiple xanthomas were evident on the elbows, interphalangeal joints and interdigital webs of the hands. Lipid-lowering therapy caused significant decrease of cholesterol and triglycerides as well as regression of the xanthomas. Flat xanthomas of the interdigital webs were also described in 3 out of 4 previously reported patients with combination of these disorders of lipoprotein metabolism. Feussner et al. (1996) stated that these xanthomas may indicate compound heterozygosity (actually double heterozygosity) for type III hyperlipoproteinemia and FH.

Saunders et al. (Neurology 43: 1467-1472,1993) reported an increased frequency of the E4 allele in a small prospective series of possible-probable AD patients presenting to the memory disorders clinic at Duke University, in comparison with spouse controls. Corder et al. (Science 261: 921-923,1993) found that the APOE\*E4 allele is associated with the late-onset familial and sporadic forms of Alzheimer disease. In 42 families with the late-onset form of Alzheimer disease (AD2; 104310), the gene had been mapped to the same region of chromosome 19 as the APOE gene. Corder et al. (1993) found that the risk for AD increased from 20 to 90% and mean age of onset decreased from 84 to 68 years with increasing number of APOE\*E4 alleles. Homozygosity for APOE\*E4 was virtually sufficient to cause AD by age 80. Lannfelt et al. (Alzheimer Dis. Assoc. Disord. 9: 166-169,1995) compared allelic frequency of apolipoprotein E4 in 13 dizygotic twin pairs discordant for Alzheimer disease and found the expected increased frequency of the epsilon-4 allele in Alzheimer compared to healthy cotwins. In a well-known American kindred with late-onset Alzheimer disease, descended from a couple who immigrated to the United States from France in the 18th century, Borgaonkar et al. (Lancet 342: 625,1993) found evidence confirming a dosage effect of the E4 allele of 6 affected individuals; 4 E4/E4 homozygotes had onset in their 60s, whereas 2 E4/E3 heterozygotes had onset at ages 77 and 78, respectively. Apolipoprotein E is found in senile plaques, congophilic angiopathy, and neurofibrillary tangles of Alzheimer disease. Strittmatter et al. (Proc. Nat. Acad. Sci. 90: 1977-1981,1993) compared the binding of synthetic amyloid beta peptide to purified APOE4 and APOE3, the most common isoforms. Both isoforms in oxidized form bound the amyloid beta peptide; however, binding to APOE4 was observed in minutes, whereas binding to APOE3 required hours. Strittmatter et al. (1993) concluded that binding of amyloid beta peptide by oxidized apoE may determine their sequestration and that isoform-specific differences in apoE binding or oxidation may be involved in the pathogenesis of the lesions of Alzheimer disease. In a study of 91 patients with sporadic Alzheimer disease and 74 controls, Poirier et al. (Lancet 342: 697-699,1993) found a significant association between E4 and sporadic AD. The association was more

pronounced in women. Scott (1993) pointed to the need for caution in the application of knowledge gained through screening of E4 in relation to this very common disorder. In a case-control study of 338 centenarians compared with adults aged 20 to 70 years of age, Schachter et al. (Lancet 342: 696,1994) found that the E4 allele of apoE, which promotes premature atherosclerosis, was significantly less frequent in centenarians than in controls (p = less than 0.001), while the frequency of the E2 allele, associated previously with types III and IV hyperlipidemia, was significantly increased (p = less than 0.01). Talbot et al. (Lancet 343: 1432-1433,1994) presented data suggesting that the E2 allele may confer protection against Alzheimer disease and that its effect is not simply the absence of an E4 allele. Corder et al. (Nature Genet. 7: 180-184,1994) presented data demonstrating a protective effect of the E2 allele, in addition to the dosage effect of the E4 allele in sporadic AD. Although a substantial proportion (65%) of AD is attributable to the presence of E4 alleles, risk of AD is lowest in subjects with the E2/E3 genotype, with an additional 23% of AD attributable to the absence of an E2 allele. The opposite actions of the E2 and E4 alleles were interpreted by Corder et al. (1994) to provide further support for the direct involvement of APOE in the pathogenesis of AD. Sanan et al. (J. Clin. Invest. 94: 860-869,1994) demonstrated that the E4 isoform binds to the beta amyloid (A-beta) peptide more rapidly than the E3 isoform. Soluble SDS-stable complexes of E3 or E4, formed by coinubation with the A-beta peptide, precipitated after several days of incubation at 37 degrees C, with E4 complexes precipitating more rapidly than E3 complexes.

Hyman et al. (Arch. Neurol. 53: 215,1996) demonstrated homozygosity for the E4 genotype in an 86-year-old man with no history of neurologic disease and whose autopsy did not reveal any neurofibrillary tangles and only rare mature senile plaques. This suggested to the authors that inheritance of apoE4 does not necessarily result in the development of dementia or Alzheimer disease. Myers et al. (Neurology 46: 673-677,1996) examined the association of apolipoprotein E4 with Alzheimer disease and other dementias in 1,030 elderly individuals in the Framingham Study cohort. They found an increased risk for Alzheimer disease as well as other dementias in patients who were homozygous or heterozygous for E4. However they pointed out that most apoE4 carriers do not develop dementia and about one-half of Alzheimer disease is not associated with apoE4. Kawamata et al. (J. Neurol. Neurosurg. Psychiat. 57: 1414-1416,1994) examined the E4 frequency in 40 patients with late-onset sporadic Alzheimer disease, 13 patients with early-onset sporadic Alzheimer disease, 19 patients with vascular dementia, and 49 nondemented control subjects. In the late-onset sporadic Alzheimer group, the allele frequency was 0.25, considerably higher than the

frequency in controls, 0.09. In contrast, there was no increased frequency in early-onset sporadic Alzheimer disease or in patients with vascular dementia. Olichney et al. (Neurology 47: 190-196,1996) found that the apolipoprotein E4 allele is strongly associated with increased neuritic plaques but not neocortical or fibrillary tangles in both Alzheimer disease and the

5 Lewy body variant. Greenberg et al. (Ann. Neurol. 38: 254-259,1995) found that the presence of apolipoprotein E4 increased the odds ratio for moderate or severe cerebral amyloid angiopathy significantly, even after controlling for the presence of Alzheimer disease. In a postmortem study, Greenberg et al. (Neurology 50: 961-965,1998) found an association between apolipoprotein E2 and vasculopathy in cerebral amyloid angiopathy. Of 75 brains

10 with complete amyloid replacement of vessel walls, only 23 had accompanying signs of hemorrhage in cracks of the vessel wall. The frequency of apolipoprotein E2 was significantly higher in the group with vasculopathy. The authors suggested that apolipoprotein E2 and E4 might promote hemorrhage through separate mechanisms: E4 by enhancing amyloid deposition and E2 by promoting rupture. O'Donnell et al. (New Eng. J. Med. 342: 240-

15 245,2000) identified a specific apolipoprotein E genotype as a risk factor for early recurrence of cerebral amyloid angiopathy: carriers of the E2 (107741.0001) or E4 (107741.0016) allele had an increased risk for early recurrence compared to individuals with the E3/E3 (107741.0015) genotype. Kawamata et al. (1994) speculated that the lower magnitude of the raised frequency of E4 in the Japanese group compared to that of North American families

20 may be due to a lower E4 frequency in the normal Japanese population and lower morbidity from Alzheimer disease in Japan. Nalbantoglu et al. (Ann. Neurol. 36: 889-895, 1994) performed apolipoprotein analysis on 113 postmortem cases of sporadic Alzheimer disease and 77 control brains in Montreal. In this population, the odds ratio associating E4 with Alzheimer disease was 15.5 and the population attributable risk was 0.53. Yoshizawa et al.

25 (Ann. Neurol. 36: 656-659,1994) examined the apolipoprotein genotypes in 83 Japanese patients with Alzheimer disease. They found a significant increase in apoE4 frequency in late-onset sporadic Alzheimer disease and a mild increase of apoE4 frequency in late- and early-onset familial Alzheimer disease. In contrast, they found no association between apoE4 and early-onset sporadic Alzheimer disease. Lucotte et al. (Ann. Neurol. 36: 681-682,1994)

30 examined the apoE4 frequency in 132 French patients with onset of Alzheimer disease after 60 years of age. They found that homozygosity for the E4 allele was associated with a younger age of disease occurrence than was heterozygosity or absence of the E4 allele. Osuntokun et al. (Ann. Neurol. 38: 463-465,1995) found no association between E4 and Alzheimer disease in elderly Nigerians, in contrast to the strong association reported in their previous study of

African Americans in Indianapolis. Levy-Lahad et al. (Ann. Neurol. 38: 678-680,1995) found that the epsilon 4 allele did not affect the age of onset in either Alzheimer disease type 4 present in Volga Germans (600753) or Alzheimer disease type 3 (104311). This suggested to them that some forms of early onset familial Alzheimer disease are not influenced by the apolipoprotein E system. Bennett et al. (Am. J. Med. Genet. 60: 1-6,1995) examined the APOE genotype in family history-positive and family history-negative cases of Alzheimer disease and found a distortion of the APOE allele frequencies similar to those with previous studies. However, they also examined the allele distribution of at-risk sibs and found an excess of the E4 allele which did not differ from that of affected sibs. In these families, they found no evidence for linkage between the APOE4 locus and Alzheimer disease. They concluded that the APOE locus is neither necessary nor sufficient to cause Alzheimer disease and speculated that it may modify the preclinical progression, and therefore the age of onset, in people otherwise predisposed to develop Alzheimer disease. Head injury is an epidemiologic risk factor for Alzheimer disease and deposition of A-beta occurs in approximately one-third of individuals dying after severe headinjury. Nicoll et al. (Nature Med. 1: 135-137,1995) found that the frequency of APOE4 in individuals with A-beta deposition following head injury (0.52) was higher than in most studies of Alzheimer disease, while in those head-injured individuals without A-beta deposition, the APOE4 frequency (0.16) was similar to controls without Alzheimer disease ( $P = \text{less than } 0.00001$ ). Thus, environmental and genetic risk factors for Alzheimer disease may act additively. In a prospective study of 69 patients with severe blunt trauma to the head, Friedman et al. (Neurology 52: 244-248,1999) found an odds ratio of 5.69 for more than 7 days ofunconsciousness and 13.93 for a suboptimal neurologic outcome at 6 months for individuals with an APOE4 allele compared to those without that allele. In a review of apolipoprotein E and Alzheimer disease, Strittmatter and Roses (Proc. Nat. Acad. Sci. 90: 1977-1981,1995) pointed out that isoform-specific differences have been identified in the binding of apoE to the microtubule-associated protein tau (157140), which forms the paired helical filament and neurofibrillary tangles, and to amyloid beta peptide (104760), a major component of the neuritic plaque. Identification of apoE in the cytoplasm of human neurons and isoform-specific binding of apoE to the microtubule-associated protein tau and MAP-2 (157130) make it possible that apoE may affect microtubule function in the Alzheimer brain. Blennow et al. (Neuroreport 5: 2534-2536,1994) demonstrated a significant reduction of CSF apolipoprotein E in Alzheimer disease compared to that of controls. They suggested that the increased reutilization of apolipoprotein E lipid complexes in the brain in Alzheimer disease may explain the low CSF concentration.



The observation that the APOE4 allele is neither necessary nor sufficient for the expression of AD emphasizes the significance of other environmental or genetic factors that, either in conjunction with APOE4 or alone, increase the risk of AD. Kamboh et al. (Nature Genet. 10: 486-488,1995) noted that among the candidate genes that might affect the risk for Alzheimer disease is alpha-1-antichymotrypsin (AACT; 107280) because, like APOE protein, AACT binds to beta-amyloid peptide with high affinity in the filamentous deposits found in the AD brain. Additionally, it serves as a strong stimulatory factor in the polymerization of beta-amyloid peptide into amyloid filaments. Kamboh et al. (Am. J. Hum. Genet. 58: 574-584,1995) demonstrated that a common polymorphism in the signal peptide of AACT (107280.0005) confers a significant risk for AD and that the APOE4 gene dosage effect associated with AD risk is significantly modified by the AACT polymorphism. They identified the combination of the AACT 'AA' genotype with the APOE4/4 genotype as a potential susceptibility marker for AD, as its frequency was 1/17 in the AD group compared to 1/313 in the general population controls. It is noteworthy that one form of Alzheimer disease (designated Alzheimer type 3, 104311), like AACT, maps to 14q; however, AACT and AD3 are located at somewhat different sites on 14q. Tang et al. (1996) compared relative risks by APOE genotypes in a collection of cases and controls from 3 ethnic groups in a New York community. The relative risk for Alzheimer disease associated with APOE4 homozygosity was increased in all ethnic groups: African American RR = 3.0; Caucasian RR = 7.3; and Hispanic RR = 2.5 (compared with the RR with APOE3 homozygosity). The risk was also increased for APOE4 heterozygous Caucasians and Hispanics, but not for African Americans. The age distribution of the proportion of Caucasian and Hispanics without AD was consistently lower for APOE4 homozygous and APOE4 heterozygous individuals than for those with other APOE genotypes. In African Americans this relationship was observed only in APOE4 homozygotes. Differences in risk among APOE4 heterozygous African Americans suggested to the authors that other genetic or environmental factors may modify the effect of APOE4 in some populations. In a study of 85 Scottish persons with early onset Alzheimer disease, St Clair et al. (J. Med. Genet. 32: 642-644,1995) found highly significant enrichment for both homozygous and heterozygous APOE epsilon-4 allele carriers in both familial and sporadic cases with a pattern closely resembling that in late onset AD. As reviewed earlier, the APOE4 allele is associated with sporadic and late-onset familial Alzheimer disease. Gene dose has an effect on risk of developing AD, age of onset, accumulation of senile plaques in the brain, and reduction of choline acetyltransferase (118490) in the hippocampus of AD patients. Poirier et al. (Proc. Nat. Acad. Sci. 92: 12260-12264,1995) examined the effect of APOE4

allele copy number on pre- and postsynaptic markers of cholinergic activity. APOE4 allele copy number showed an inverse relationship with residual brain CHAT activity and nicotinic receptor binding sites in both the hippocampal formation and the temporal cortex of AD subjects. AD subjects lacking the APOE4 allele showed CHAT activities close to or within the age-matched normal control range. Poirier et al. (1995) then assessed the effect of the APOE4 allele on cholinomimetic drug responsiveness in 40 AD patients who completed a double-blind, 30-week clinical trial of the cholinesterase inhibitor tacrine. Results showed that more than 80% of APOE4-negative AD patients showed marked improvement after 30 weeks, whereas 60% of APOE4 carriers had poor responses. Polvikoski et al. (New Eng. J. Med. 333: 1242-1247,1995) reported on an autopsy study involving neuropathologic analysis and DNA analysis of frozen blood specimens performed in 92 of 271 persons who were at least 85 years of age, who had been living in Vantaa, Finland, on April 1, 1991, and who had died between that time and the end of 1993. All subjects had been tested for dementia. Apolipoprotein E genotyping was done with a solid-phase minisequencing technique. The percentage of cortex occupied by methenamine silver-stained plaques was used as an estimate of the extent of beta-amyloid protein deposition. They found that the APOE4 allele was significantly associated with Alzheimer disease. Even in elderly subjects without dementia, the apolipoprotein E4 genotype was related to the degree of deposition of beta-amyloid protein in the cerebral cortex. Reiman et al. (New Eng. J. Med. 334: 752-758,1996) found that in late middle age, cognitively normal subjects who were homozygous for the APOE4 allele had reduced glucose metabolism in the same regions of the brain as in patients with probable Alzheimer disease. These findings provided preclinical evidence that the presence of the APOE4 allele is a risk factor for Alzheimer disease. Positron-emission tomography (PET) was used in these studies; Reiman et al. (1996) suggested that PET may offer a relatively rapid way of testing treatments to prevent Alzheimer disease in the future. In late-onset familial AD, women have a significantly higher risk of developing the disease than do men. Studying 58 late-onset familial AD kindreds, Payami et al. (Am. J. Hum. Genet. 58: 803-811,1996) detected a significant gender difference for the APOE4 heterozygous genotype. In women, APOE4 heterozygotes had higher risk than those without APOE4; there was no significant difference between APOE4 heterozygotes and APOE4 homozygotes. In men, APOE4 heterozygotes had lower risk than APOE4 homozygotes; there was no significant difference between APOE4 heterozygotes and those without APOE4. A direct comparison of APOE4 heterozygous men and women revealed a significant 2-fold increased risk in women. These results were corroborated in studies of 15 autopsy-confirmed AD kindreds from the National Cell Repository at Indiana University

Alzheimer Disease Center. Mahley (Science 240: 622-630, 1988) provided a review documenting the expanding role of apoE as a cholesterol transport protein in cell biology. The pronounced production and accumulation of apoE in response to peripheral nerve injury and during the regenerative process indicates, for example, that apoE plays a prominent role in the redistribution of cholesterol to the neurites for membrane biosynthesis during axon elongation and to the Schwann cells for myelin formation. Poirier (Trends Neurol. Sci. 17: 525-530, 1994) reviewed the coordinated expression of apoE and its receptor, the apoE/apoB LDL receptor (143890), in the regulation of transport of cholesterol and phospholipids during the early and intermediate phases of reinnervation, both in the peripheral and in the central nervous system. He proposed that the linkage of the E4 allele to Alzheimer disease (104300) may represent dysfunction of the lipid transport system associated with compensatory sprouting and synaptic remodeling central to the Alzheimer disease process. Tomimoto et al. (Acta Neuropath. 90: 608-614, 1995) found only 3 cases with focal accumulation of apolipoprotein E in dystrophic axons and accompanying macrophages in 9 cases of cerebral vascular disease and 4 control subjects. The results suggested to the authors that apolipoprotein E may have a role in recycling cholesterol in other membrane components in the brain, but that this phenomenon is restricted to the periphery of infarctions and may be less prominent than in the peripheral nervous system. Egensperger et al. (Biochem. Biophys. Res. Commun. 224: 484-486, 1996) determined the apoE allele frequencies in 35 subjects with neuropathologically confirmed Lewy body parkinsonism with and without concomitant Alzheimer lesions, 27 patients with AD, and 54 controls. They concluded that the apoE4 allele does not function as a risk factor which influences the development of AD lesions in PD. In aggregate, the association studies on apoE in Alzheimer disease suggest epsilon-4 accelerates the neurodegenerative process in Alzheimer disease. However, in 3 independent studies, Kurz et al. (Neurology 47: 440-443, 1996), Growdon et al. (Neurology 47: 444-448, 1996), and Asada et al. (Neurology 47: 603 only 1996) found no differences in the clinical rate of decline of newly diagnosed Alzheimer disease patients with or without the epsilon-4 allele. Bickeboller et al. (Am. J. Hum. Genet. 60: 439-446, 1997) confirmed the increased risk for AD associated with the APOE4 allele in 417 patients compared with 1,030 control subjects. When compared to the APOE3 allele, the authors demonstrated an increased risk associated with the APOE4 allele (odds ratio = 2.7) and a protective effect of the APOE2 allele (odds ratio = 0.5). An effect of E4 allele dosage on susceptibility was confirmed: the odds ratio of E4/E4 versus E3/E3 = 11.2; odds ratio of E3/E4 versus E3/E3 = 2.2. In E3/E4 individuals, sex-specific lifetime risk estimates by age 85 years (i.e., sex-specific penetrances by age 85 years) were

0.14 for men and 0.17 for women. Houlden et al. (Am. J. Med. Genet. 81: 117-121,1998) found that the APOE genotype is only a risk factor for early-onset AD families with no lesion detectable in the presenilin or APP gene. Meyer et al. (Nature Genet. 19: 321-322,1998) presented data on an elderly population which suggested that apoE genotype influences the age-specific risk of Alzheimer disease but that, regardless of apoE genotype, more than half of the population will not develop AD by age 100. ApoE genotype did not appear to influence whether subjects will develop AD, but the study did confirm that the apoE4 alleles influence when susceptible individuals will develop AD. The findings could be explained by a gene or genes independent of apoE that condition vulnerability. Wiebusch et al. (Hum. Genet. 104: 158-163,1999) conducted a case-control study of 135 pathologically confirmed AD cases and 70 non-AD controls (age of death greater than or equal to 60 years) in whom they genotyped for APOE epsilon-4 and BCHE-K (177400.0005). The allelic frequency of BCHE-K was 0.13 in controls and 0.23 in cases, giving a carrier odds ratio of 2.1 (95% confidence interval (CI) 1.1-4.1) for BCHE-K in confirmed AD. In an older subsample of 27 controls and 89 AD cases with ages of death greater than or equal to 75 years, the carrier odds ratio increased to 4.5 (95% CI 1.4-15) for BCHE-K. The BCHE-K association with AD became even more prominent in carriers of APOE epsilon-4. Only 3 of 19 controls compared with 39 of 81 cases carried both, giving an odds ratio of 5.0 (95% CI 1.3-19) for BCHE-K carriers within APOE epsilon-4 carriers. The authors concluded that the BCHE-K polymorphism is a susceptibility factor for AD and enhances the AD risk from APOE epsilon-4 in an age-dependent manner.

Saunders et al. (Lancet 342: 710-711,1993) found no association of E4 with other amyloid-forming diseases, i.e., Creutzfeldt-Jakob disease (CJD; 123400), familial amyloidotic polyneuropathy, and Down syndrome (190685). On the other hand, Amouyel et al. (Lancet 344: 1315-1318,1994) concluded that E4 is a major susceptibility factor for CJD. They found a relative risk of CJD between subjects with at least one E4 allele and subjects with none to range between 1.8 and 4.2, depending on the control group used. A variation in disease duration was also noted, depending on apoE genotype, with an increase in duration of illness in E2 allele carriers. Frisoni et al. (Stroke 25: 1703,1994) assessed the apoE allele frequency in 51 elderly control subjects, 23 subjects with vascular dementia, and 93 patients with Alzheimer disease. There was increased frequency of the E4 allele both in Alzheimer disease and in vascular dementia with respect to both elderly and young control subjects. There was no difference in the proportion of E2, E3, and E4 frequency in Alzheimer disease and vascular dementia patients. Slioter et al. (Lancet 348: 334 only,1996) compared E4 allele frequency between 185 patients with Alzheimer disease and those with other types of dementia. The

authors found little predictive value in distinguishing Alzheimer patients from those with other forms of dementia using APOE genotyping. In contrast, Mahieux et al. (Stroke 25: 1703-1704,1994) found an increase of E4 in Alzheimer disease, but not in vascular dementia. They speculated that the difference between their results and those of Frisoni et al. (1994) may be attributable to the small size of the groups or to the different mean ages of the populations that they studied. McCarron et al. (Neurology 53: 1308-1311,1999) performed a metaanalysis that demonstrated a significantly higher frequency of E4 carriers in individuals with ischemic cerebrovascular disease than in control subjects (odds ratio, 1.73). Myers et al. (1996) examined the association of apolipoprotein E4 with Alzheimer disease and other dementias in 1,030 elderly individuals in the Framingham Study cohort. They found an increased risk for Alzheimer disease as well as other dementias in patients who were homozygous or heterozygous for E4. However they pointed out that most apoE4 carriers do not develop dementia and about one-half of Alzheimer disease is not associated with apoE4. Blesa et al. (Ann. Neurol. 39: 548-551,1996) found an apoE epsilon-4 frequency of 0.315 in patients with age-related memory decline without dementia, similar to the 0.293 allele frequency found in an Alzheimer disease group. This contrasted to the frequency of 0.057 found in their control group. Payami et al. (Am. J. Hum. Genet. 60: 948-956,1997) reported the results of a prospective case-control study that enlisted 114 Caucasian subjects who were physically healthy and cognitively intact at age 75 years and who were followed, for an average of 4 years, with neurologic, psychometric, and neuroimaging examinations. Excellent health at entry did not protect against cognitive decline. Incidence of cognitive decline rose sharply with age. E4 and a family history of dementia (independent of E4) were associated with an earlier age at onset of dementia. Subjects who had E4 or a family history of dementia had a 9-fold-higher age-specific risk for dementia than did those who had neither. From these observations, Payami et al. (1997) suggested that the rate of cognitive decline increases with age and that APOE and other familial/genetic factors influence the onset age throughout life. In a study of 79 patients with Parkinson disease, 22 of whom were demented, Marder et al. (Neurology 44: 1330-1331,1994) found that the E4 allele frequency was 0.13 in patients without dementia and 0.068 in those with dementia as opposed to a control value of 0.102. The authors concluded that the biologic basis for dementia in Parkinson disease differs from that of Alzheimer disease. Tabaton et al. (Neurology 45: 1764-1765,1995) found that, although apolipoprotein E immunoreactivity was found to be associated with neurofibrillary tangles in an autopsy study of 12 patients with progressive supranuclear palsy (601104), the apolipoprotein E allele frequency was similar to that of age-matched controls. Farrer et al.

(Exp. Neurol. 136: 162-170,1995) demonstrated that the number of epsilon-4 alleles was inversely related to the age at onset of Pick disease (172700). Their results suggested that epsilon-4 may be a susceptibility factor for dementia and not specifically for AD. Mui et al. (Ann. Neurol. 38: 460-463,1995) found no association between apolipoprotein E4 and the incidence or the age of onset of sporadic of autosomal dominant amyotrophic lateral sclerosis (105400). Garlepp et al. (Ann. Neurol. 38: 957-959,1995) found an increased frequency of the epsilon 4 allele in patients with inclusion body myositis (147421) compared with that in patients with other inflammatory muscle diseases or that in the general population. In a study of apoE genotypes in schizophrenic patients coming to autopsy, Harrington et al. (Neurosci. Lett. 202: 101-104, 1995) found that schizophrenia is associated with an increased E4 allele frequency. The E4 allele frequency in schizophrenia was indistinguishable from that found in either Alzheimer disease or Lewy body dementia (127750). From the age range at autopsy (from 19 to 95 years), they determined that the epsilon-4 frequency was not associated with increased age. Betard et al. (Neuroreport 5: 1893-1896,1994) analyzed allele frequencies of apoE in 166 autopsied French-Canadian patients with dementia. The E4 frequency was highest in Lewy body dementia (0.472); presenile Alzheimer disease (0.405); senile Alzheimer disease (0.364); and Alzheimer disease with cerebrovascular disease (0.513). In contrast, the E4 allele frequency was 0.079 in autopsied cases of individuals with vascular dementia but no changes of Alzheimer disease. Subjects with vascular dementia demonstrated an increased relative E2 allele frequency of 0.211 compared to 0.144 in elderly controls. In contradistinction to the findings of Betard et al. (1994), Lippa et al. (Neurology 45: 97-103,1995) found much lower frequency of E4, 0.22, when they were careful to exclude Lewy body patients that had concurrent Alzheimer disease by the Cerat criterion. They did, however, find that a neuritic degeneration in CA2-3 was slightly greater in those Lewy body disease patients with the apoE4 allele than those with the E3/3 genotype. Hyman et al. (Proc. Nat. Acad. Sci. 92: 3586-3590,1995) found that senile plaques in the Alzheimer disease of Down syndrome were abnormally large, whereas those of APOE4-related Alzheimer disease were unusually numerous. The findings suggested that the pathology in Down syndrome is due to increased amyloid production and deposition, whereas that in APOE4, disease is related to an increased probability of senile plaque initiation. Royston et al. (Neuroreport 5: 2583-2585,1994) assessed the apoE genotype in elderly Down syndrome patients and found that the epsilon-2 variant was associated both with increased longevity and a significantly decreased frequency of Alzheimer-type dementia. They noted that none of their elderly Down patients was homozygous for the epsilon-4 allele. In a case-control study of apoE genotypes in Alzheimer

disease associated with Down syndrome, van Gool et al. (Ann. Neurol. 38: 225-230,1995) showed that the frequencies of apoE type 2, 3, or 4 were not significantly different in Down syndrome cases with Alzheimer disease compared with aged-matched Down syndrome controls. The apoE 4 frequency in Down syndrome cases with Alzheimer disease was significantly lower than in any other Alzheimer disease populations studied thus far, suggesting that apoE4 does not significantly affect the pathogenesis of Alzheimer disease in Down syndrome patients. Kehoe et al. (J. Med. Genet. 36: 108-111,1999) showed that the APOE epsilon-2/epsilon-3 genotype is associated with significantly earlier age of onset of Huntington disease (143100) in males than in females. This sex difference was not apparent for any other APOE genotypes.

Olaisen et al. (Hum. Genet. 62: 233-236,1982) found linkage of C3 (120700) and apoE with a lod score of 3.00 in males at a recombination fraction of 13%. Since the C3 locus is on chromosome 19, apoE can be assigned to that chromosome also. The authors stated that preliminary evidence suggested that the apoE locus is close to the secretor locus (182100).

Berg et al. (Cytogenet. Cell Genet. 37: 417,1984) studied apoE-C3 linkage with a C3 restriction fragment length polymorphism. Low positive lod scores were found when segregation was from a male (highest score at recombination fraction 0.17). Using DNA probes, Das et al. (J. Biol. Chem. 260: 6240-6247,1985) mapped the apoE gene to chromosome 19 by Southern blot analysis of DNA from human-rodent somatic cell hybrids.

Humphries et al. (Clin. Genet. 26: 389-396,1984) used a common TaqI RFLP near the APOC2 gene to demonstrate close linkage to APOE in 7 families segregating for APOE protein variants. No recombination was observed in 20 opportunities. Apparent linkage disequilibrium was observed. On the other hand, Houlston et al. (Hum. Genet. 83: 364-368,1989), using a robust PCR-based method for apoE genotyping, found no strong linkage disequilibrium between the APOE and APOC2 loci. Gedde-Dahl et al. (Hum. Genet. 67: 178-182,1984) found linkage between Se and APOE with a peak lod score of 3.3 at recombination fraction of 0.08 in males and 1.36 at 0.22 in females, and linkage between APOE and Lu with a lod score 4.52 at zero recombination (sexes combined). The C3-APOE linkage gave lod score 4.00 at theta 0.18 in males and 0.04 at theta 0.45 in females. Triply heterozygous families confirmed that APOE is on the Se side and on the Lu side of C3. Lusis et al. (Proc. Nat. Acad. Sci. 83: 3929-3933,1986) used a reciprocal whole arm translocation between the long arm of 19 and the short arm of chromosome 1 to map APOC1, APOC2, APOE and GPI to the long arm and LDLR, C3 and PEPD to the short arm. Furthermore, they isolated a single lambda phage that

carried both APOC1 and APOE separated by about 6 kb of genomic DNA. Since family studies indicate close linkage of APOE and APOC2, the 3 must be in a cluster on 19q. Because apolipoprotein E is a ligand for receptors that clear remnants of chylomicrons and very low density lipoproteins, lack of apoE would be expected to cause accumulation in plasma of cholesterol-rich remnants whose prolonged circulation should be atherogenic. Zhang et al. (Science 258: 468-471,1992) demonstrated that this was indeed the case: apoE-deficient mice generated by gene targeting (Piedrahita et al., Proc. Nat. Acad. Sci. 89:4471-4475, 1992) had 5 times normal plasma cholesterol and developed foam cell-rich depositions in their proximal aortas by age 3 months. These spontaneous lesions progressed and caused severe occlusion of the coronary artery ostium by 8 months. Plump et al. (Cell 71:343-353,1992) independently found the same in apoE-deficient mice created by homologous recombination in ES cells. The findings in the mouse model are comparable to those in 3 human kindreds with inherited apoE deficiency (Ghiselli et al., Science 214: 1239-1241, 1981; Mabuchi et al., Metabolism 38: 115-119,1989; Kurosaka et al., Atherosclerosis 88: 15-20, 1991). Commenting on the articles of Plump et al. (1992) and Zhang et al. (1992), Brown and Goldstein (Cell 71: 187-188,1992) pointed out that molecular genetics has given us the opportunity to satisfy Koch's postulates for multifactorial metabolic diseases. Further use of the apoE gene-targeted mice was made by Linton et al. (Science 267: 1034-1037,1995), who showed that the severe hyperlipidemia and atherosclerosis in these mice could be prevented by bone marrow transplantation. Although the majority of apoE in plasma is of hepatic origin, the protein is synthesized by a variety of cell types, including macrophages. Because macrophages derive from hematopoietic cells, bone marrow transplantation seemed a possible therapeutic approach. ApoE-deficient mice given transplants of normal bone marrow showed apoE in the serum and a normalization of serum cholesterol levels. Furthermore, they showed virtually complete protection from diet-induced atherosclerosis. To unravel the metabolic relationship between apoE and apoC1 in vivo, van Ree et al. (Hum. Molec. Genet. 4: 1403-1409,1995) generated mice deficient in both apolipoproteins. This enabled subsequent production of transgenic mice with variable ratios of normal and mutant apoE and apoC1 on a null background. They found that double inactivation of the ApoE and ApoC1 (107710) loci in mice, as well as single inactivations at either one of these loci, also affected the levels of RNA expression of other members of the Apoe-c1-c2 cluster. Homozygous Apoe-c1 knockout mice were hypercholesterolemic and, with serum cholesterol levels more than 4 times the control value, resembled mice solely deficient in apoE.



Kashyap et al. (J. Clin. Invest. 96: 1612-1620,1995) noted that apolipoprotein E-deficient mice, generated using homologous recombination for targeted gene disruption in embryonic stem cells, developed marked hyperlipidemia as well as atherosclerosis. Kashyap et al. (1995) found that intravenous infusion of a recombinant adenovirus containing the human APOE gene resulted in normalization of the lipid and lipoprotein profile with markedly decreased total cholesterol, VLDL, IDL, and LDL, as well as increased HDL. A marked reduction in the extent of aortic atherosclerosis was observed after one month. Plump et al. (1992) and Zhang et al. (1992) created apoE-deficient mice by gene targeting in embryonic stem cells. These mice displayed severe hypercholesterolemia even on a low-fat, low cholesterol diet. A key regulator of cholesterol-rich lipoprotein metabolism, apoE, is synthesized by numerous extrahepatic tissues. It is synthesized, for example, in macrophages. To assess the contribution of macrophage-derived apoE to hepatic clearance of serum cholesterol, Boisvert et al. (J. Clin. Invest. 96: 1118-1124,1995) performed bone marrow transplantation on hypercholesterolemic apoE-deficient 'knockout' mice. Serum cholesterol levels dropped dramatically in the bone marrow-treated mice largely due to a reduction in VLDL cholesterol. The extent of atherosclerosis in the treated mice was also greatly reduced. Wildtype apoE mRNA was detected in the liver, spleen, and brain of the treated mice indicating that gene transfer was successfully achieved through bone marrow transplantation. Masliah et al. (Exp. Neurol. 136: 107-122, 1995) observed an age-dependent loss of synaptophysin-immunoreactive nerve terminals and microtubule-associated protein 2-immunoreactive dendrites in the neocortex and hippocampus of apoE-deficient (knockout) mice. They suggested that apoE may play a role in maintaining the stability of the synaptodendritic apparatus. Sullivan et al. (J. Biol. Chem. 272: 17972-17980,1997) found that when the mouse apolipoprotein E gene was replaced by the human APOE3 gene in transgenic mice, diet-induced hypercholesterolemia and atherosclerosis were considerably enhanced. To assess the effects of human APOE isoforms on deposition of amyloid-beta protein in vivo, Holtzman et al. (J. Clin. Invest. 103: R15-R21,1999) bred apoE3 and apoE4 hemizygous (+/-)transgenic mice expressing APOE by astrocytes to mice homozygous (+/+) for a mutant amyloid precursor protein, V717F (104760.0003), transgene that developed age-dependent Alzheimer disease neuropathology. All mice had an apoE null (-/-) background. By 9 months of age, the mice heterozygous for the human V717F mutant had developed deposition of amyloid-beta protein, and the quantity of amyloid-beta deposits was significantly less than that seen in heterozygous mice expressing mouse apoE. In contrast to effects of mouse apoE, similar levels of human apoE3 and apoE4 markedly suppressed early amyloid-beta deposition at 9 months of

age in the V717F heterozygous transgenic mice, even when compared with mice lacking apoE. These findings suggested that human APOE isoforms decrease amyloid-beta aggregation or increase amyloid-beta clearance relative to an environment in which mouse apoE or no apoE is present. Raber et al. (Nature 404: 352-354,2000) tested the spatial memory of transgenic mice carrying human forms of amyloid precursor protein and either apoE3 or apoE4 and found that it was impaired in mice with apoE4 but not in those with apoE3, even though the levels of beta-amyloid in their brains were comparable. As no plaques were detectable in APP and APP/apoE mice at 6 months of age, Raber et al. (2000) concluded that the differential effects of apoE isoforms on human amyloid precursor protein/amyloid beta-induced cognitive impairments are independent of plaque formation. Learning deficits were more significant in female than in male mice. These sex-dependent differences may relate to the increased susceptibility of women to APOE4-associated cognitive deficits.

Corbo and Scacchi (Ann. Hum. Genet. 63: 301-310,1999) analyzed the APOE allele distribution in the world. They pointed out that the APOE3 allele is the most frequent in all human groups, especially in populations with a long-established agricultural economy such as those of the Mediterranean basin, where the allele frequency is 0.849-0.898. The frequency of the APOE4 allele, the ancestral allele, remains higher in populations such as Pygmies (0.407) and Khoi San (0.370), aborigines of Malaysia (0.240) and Australia (0.260), Papuans (0.368), some Native Americans (0.280), and Lapps (0.310) where an economy of foraging still exists, or food supply is (or was until shortly before the time of the report) scarce and sporadically available. The APOE2 frequency fluctuates with no apparent trend (0.145-0.02) and is absent in Native Americans. Corbo and Scacchi (1999) suggested that the APOE4 allele, based on some functional properties, may be a 'thrifty' allele. The exposure of APOE4 to the environmental conditions at the time of the report (Western diet, longer lifespans) may have rendered it a susceptibility allele for coronary artery disease and Alzheimer disease. The absence of the association of APOE4 with either disorder in sub-Saharan Africans, and the presence of the association in African Americans, seems to confirm this hypothesis.

In a large multicenter case control study of myocardial infarction using 567 cases and 678 controls, Lambert et al. (Hum. Molec. Genet. 9: 57-61,2000) identified an increased risk of myocardial infarction among patients carrying the -219T allele, a promoter polymorphism. The odds ratio was 1.29, with a 95% confidence interval of 1.09 to 1.52 and a P value of less than 0.003. The effect of the allele was independent of the presence of other promoter polymorphisms or mutations including the APOE epsilon-2/epsilon-3/epsilon-4 polymorphism. Moreover, the -219T allele greatly decreased the APOE plasma concentrations

in a dose-dependent manner (P less than 0.008). Lambert et al. (2000) concluded that the -219 G-to-T polymorphism of the APOE regulatory region is a genetic susceptibility risk factor for myocardial infarction and constitutes another common risk factor for both neurodegenerative and cardiovascular diseases. To determine the effect of APOE on deposition of amyloid-beta and Alzheimer disease pathology, Holtzman et al. (Proc. Nat. Acad. Sci.97: 2892-2897,2000) compared APP(V717F) transgenic mice expressing mouse, human, or no APOE. A severe, plaque-associated neuritic dystrophy developed in the transgenic mice expressing mouse or human APOE. Although significant levels of amyloid-beta deposition also occurred in APP(V717F) transgenics that completely lacked APOE, neuritic degeneration was virtually absent. Expression of APOE3 and APOE4 in APP(V717F) transgenics who had knockout of APOE resulted in fibrillar amyloid-beta deposits and neuritic plaques by 15 months of age, and more than 10-fold more fibrillar deposits were observed in APOE4-expressing APP(V717F) transgenic mice. The data demonstrated a critical and isoform-specific role for APOE in neuritic plaque formation, a pathologic hallmark of Alzheimer disease.

## 15 NOV19

A disclosed NOV19 nucleic acid of 3839 nucleotides (also referred to as CG55906-01) (SEQ ID NO:57) encoding a novel S3-12-like protein is shown in Table 19A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 131-133 and ending with a TAG codon at nucleotides 3806-3808. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined and the start and stop codons are in bold in Table 19A.

**Table 19A. NOV19 nucleotide sequence (SEQ ID NO:57)**

<u>GTGAGGCCAGGCCTGCAGGTGGGTGTCGGGCTGCTCAGGCTTTCAGTGGGGAGTGGGTGT</u>
<u>GGGATGGGAGGCTAGGGAACCCCCATTACGCACCTTCTCTGCCCCCTTCCAGCTTCTCA</u>
<u>CGTTCTCACTATGCTCTGCTCCAGACGAAGGGAGACGGGATCCCCCAAACCGAAGGGCAA</u>
<u>GCCCCCGCCCCCATGCAGACCCTGGGCAGCTTCTTTGGGTCCCTGCCTGGCTTCAGCTC</u>
<u>TGCCCCGAACCTGGTGGCCAACGCACATAGCTCGGTGCGGGCCAAAGACCTGGTGTGTTT</u>
<u>CAAGATGTCCAGGGCCAAAGGATGCCGTGTCTCCGGGGTGGCCAGCGTGGTGGACGTGGC</u>
<u>TAAGGGAGTGGTCCAGGGAGGCCTGGACACCACTCGGTCTGCACTTACGGGCACCAAGGA</u>
<u>GGTGGTGTCCAGCGGGGTACAGGGGCCATGGACATGGCTAAGGGGGCCGTCCAAGGGGG</u>
<u>TCTGGACACCTCGAAGGCTGTCTCTACCGGCACCAAGGACACGGTGTCCACTGGGCTCAC</u>
<u>GGGGGCAGTGAATGTGGCCAAAGGGACCGTACAGGCCGGTGTGGACACCACCAAGACTGT</u>
<u>GCTGACCGGCACCAAAGACACAGTGACTACTGGGGTCATGGGGGCAGTGAACCTTGGCCAA</u>
<u>AGGGACTGTCCAGACTGGCGTGGAAACCTCCAAGGCTGTGCTGACCGGCACCAAGATGC</u>
<u>TGTGTCCACTGGGCTCACAGGGGCAGTGAATGTGGCCAGAGGAAGCATTACAGACCGGTG</u>
<u>GGACACCAGTAAGACTGTCCTAACAGGTACCAAGGACACCGTCTGTAGTGGGGTGACTGG</u>
<u>TGCCATGAATGTGGCCAAAGGAACCATCCAGACCGGCGTGGACACCAGTAAGACTGTCT</u>
<u>AACAGGTACCAAGGACACCGTCTGTAGTGGGGTGACTGGTGCCATGAATGTGGCCAAAGG</u>
<u>AACCATCCAGACCGGCGTGGACACCAGTAAGACTGTCCTAACAGGTACCAAGGACACCGT</u>
<u>CTGTAGTGGGGTGACTGGTGCCATGAATGTGGCCAAAGGAACCATCCAGACCGGCGTGGA</u>
<u>CACCACCAAGACTGTCCTAACTGGCACCAAGAACACTGTCTGCAGTGGGGTGACCGGTGC</u>

CGTGAACCTTGGCCAAAGAGGCCATCCAGGGGGCCTGGATACCACCAAGTCTATGGTCAT  
GGGTACGAAAGACACGATGTCCACTGGGCTCACAGGGGCAGCGAATGTGGCCAAAGGGGGC  
CATGCAAACTGGGCTGAACACAACCCAAAATATCGCAACAGGTACAAAGGACACCGTCTG  
CAGTGGGGTGACTGGTGCCATGAATTTGGCCAGAGGAACCATCCAGACAGGCGTGGACAC  
CACCAAGATCGTTCTAACTGGTACCAAGGACACTGTCTGCAGTGGGGTCACCGGTGCTGC  
GAATGTGGCCAAAGGGGCGCTCCAGGGCGGCCTGGACACTACAAAGTCTGTCTGACTGG  
CACTAAAGATGCTGTGTCCACTGGGCTCACAGGGGCTGTGAACGTGGCCAAAGGGACCGT  
CCAGACCGGCGTAGACACCACCAAGACTGTCTTAACCGGCACCAAGGACACCGTCTGCAG  
TGGGGTGACCAGTGCTGTGAACGTGGCCAAAGGGGCGCTCCAGGGGGCCTGGACACCAC  
CAAGTCTGTGGTCATAGGTACAAAAGACACGATGTCCACTGGGCTCACGGGGGCAGCGAA  
TGTGGCCAAAGGGGCTGTCCAGACAGGTGTAGACACAGCCAAGACCGTGTGACCGGCAC  
CAAGGACACAGTGACTACTGGGCTCGTGGGGGCAGTGAATGTGCGCCAAAGGGACCGTCCA  
GACAGGCATGGACACCACCAAACTGTCTTAACCGGTACCAAGGACACCATCTACAGTGG  
GGTCACCAAGTGCCGTGAACGTGGCCAAAGGGGCTGTGCAAACTGGGCTGAAAACGACCCA  
AAATATCGCGACAGGTACAAAGAACACCTTTGGCAGTGGGGTGACCAGTGCTGTGAATGT  
GGCCAAAGGGGCTGCCAGACAGGTGTAGACACGGCCAAAGACCGTGTGACCGGCACCAA  
GGACACAGTCACTACTGGGCTCATGGGGGCAGTGAATGTGCGCCAAAGGGACTGTCCAGAC  
CAGTGTGGACACCACCAAGACTGTCTTAACCTGGTACCAAGGACACCGTCTGCAGTGGGGT  
GACCGGTGCTGCGAATGTGGCCAAAGGGGCGCATCCAAGGGGGCCTGGACACTACAAAGTC  
TGTCTGACTGGCACTAAAGATGTGTGTCCACTGGGCTCACAGGGGCTGTGAAGTTGGC  
CAAAGGGACTGTCCAGACCGGCATGGACACCACCAAGACTGTGTAACTGGTACCAAGGA  
TGCTGTGTGCACTGGGGTGACCGGTGCTGCGAATGTGGCCAAAGGGGCGCTCCAGATGGG  
TGTAGACACGGCCAAGACCGTGTGACCGGTACCAAGGACACTGTCTGCAGTGGGGTCAC  
CGGTGCTGCGAACGTGGCCAAAGGGTGTGTGCAAACTGGGCTGAAAACGACCCAAAATAT  
CGCAACAGGTACAAAGAACACCTTTGGCAGTGGGGTGACCGGTGCTGCGAAAGTGGCCAA  
AGGGGCGCTCCAGGGGGGCGCTGGACACTACAAAGTCTGTCTGACTGGCACTAAAGATGC  
CGTGTCCACTGGGCTCACAGGGGCTGTGAACCTGGCCAAAGGGACTGTCCAGACCGGCGT  
GGACACCAGCAAGACTGTCTGACCGGTACCAAGGACACCGTCTGCAGTGGAGTCACTGG  
TGCCGTAATGTGGCCAAAGGGACCGTCCAGACAGGTGTGGACACAGCCAAGACCGTGCT  
GAGTGGCGCTAAGGATGCAGTGACTACTGGAGTCACGGGGGCAGTGAATGTGGCCAAAGG  
AACCGTGCAGACCGGCGTGGACGCGCTCCAAGGCTGTGCTTATGGGTACCAAGGACACTGT  
CTTCAGTGGGGTTACCGGTGCCATGAGCATGGCCAAAGGGGCGCTCCAGGGGGCGCTGGA  
CACCACCAAGACAGTGTGACCGGAACCAAGACGCAGTGTCCGCTGGGCTCATGGGGTC  
AGGGAACGTGGCGACAGGGGCCACCCACACTGGCCTCAGCACCTTCCAGAACTGGTTACC  
TAGTACCCCGCCACCTCCTGGGGTGGACTCACCAGTTCAGGACCACAGCTCAGCTGGC  
TGCCCTCCAGCCTGGGCCAAAGGTGCTGTGCGCGGAACAGGGGAGCTACTTCGTTCTGTTT  
AGGTGACCTGGGTCCAGCTTCCGCCAGCGGGCATTGTAACACGCGGTGAGCCACCTGCA  
GCACGGCCAGTTCAGCCAGGGACACTCTGGCCAGCTCCAGGACTGCTTCAGGCTGAT  
TGAAAAGGCCCAGCAGGCTCCAGAAGGGCAGCCACGTCTGGACCAGGGCTCAGGTGCCAG  
TGCGGAGGACGCTGCTGTCCAGGAGAGGGTCTGCGGCCTTCTCCGGCAGCTGCACACGGC  
CTACAGTGGCCTGGTCTCCAGCCTCCAGGGCCTGCCCGCGAGCTCCAGCAGCCAGTGGG  
GCGGGCGCGGCACAGCCTCTGTGAGCTCTATGGCATCGTGGCCTCAGCTGGCTCTGTAGA  
GGAGCTGCCCGCAGAGCGGCTGGTGCAGAGCCGAGGGTGTGCACCAGGCTTGGCAGGG  
GTTAGAGCAGCTGCTGGAGGGCCTACAGCACAAATCCCCGCTCAGCTGGCTGGTAGGGCC  
CTTCGCCTTGCCCGCTGGCGGGCAGTAGCTGTAGGAGCCTGCAGGCCCGGCGCGGGGTC

The S3-12-like NOV19 disclosed in this invention maps to chromosome 19.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 2100 of 3062 bases (68%) identical to a gb:GENBANK-ID:AF064748|acc:AF064748.1 mRNA from *Mus musculus* (*Mus musculus* S3-12 mRNA, complete cds).

A disclosed NOV19 polypeptide (SEQ ID NO:58) encoded by SEQ ID NO:57 has 1225 amino acid residues and is presented in Table 19B using the one-letter code. Although SignalP, Psort and/or hydropathy suggest that the S3-12-like NOV19 protein may be localized

at the cytoplasm, with a certainty of 0.4500, the protein predicted here is similar to the S3-12 family, some members of which are membrane localized. Therefore it is likely that this novel S3-12-like protein is available at the same sub-cellular localization and hence accessible to a diagnostic probe and for various therapeutic applications. In an alternative embodiment

5 NOV19 is likely to be localized to the microbody (peroxisome) with a certainty of 0.3000, or to the lysosome (lumen) with a certainty of 0.2966, or to the mitochondrial matrix space with a certainty of 0.1000.

**Table 19B. NOV19 protein sequence (SEQ ID NO:58)**

MSAPDEGRRDPPKPKGKPPAPMQTLGSFFGSLPGFSSARNLVANAHSSVGAKDLVCSKMS  
RAKDAVSSGVASVVDVAKGVVQGGDLTTRSALTGTKEVVSSGVTGAMDMAKGAVQGGDLT  
SKAVLTGKTDTVSTGLTGAVNVAAGTVQAGVDTTKTVLTGKTDTVTTGVMGAVNLAAGTV  
QTGVETSKAVLTGKTDAVSTGLTGAVNVARGSIQTGVDTSTKTDLTGTGKDTVCSGVTGAMN  
VAKGTIQTGVDTSTKTDLTGTGKDTVCSGVTGAMNVAAGTIQTGVDTSTKTDLTGTGKDTVCSG  
VTGAMNVAAGTIQTGVDTTKTVLTGKTNTVCSGVTGAVNLAKEAIQGGDLTTSKSMVMGK  
DTMSTGLTGAAANVAKGAMQTLNNTQNIATGKTDTVCSGVTGAMNLAGTIQTGVDTTKI  
VLTGKTDTVCSGVTGAANVAKGAVQGGDLTTSKSVLTGKTDAVSTGLTGAVNVAAGTVQGT  
VDTTKTVLTGKTDTVCSGVTSAVNVAAGAVQGGDLTTSKSVIGTKDTMSTGLTGAAANVAK  
GAVQGTGVDATAKTVLTGKTDTVTTGLVGAANVAAGTVQGTGMDTTKTVLTGKTDTIYSGVTS  
AVNVAAGAVQGTGLKTTQNIATGKTNTFGSGVTSAVNVAAGAAQTGVDTAKTVLTGKTDTV  
TTGLMGAVNVAAGTVQTSVDTTKTVLTGKTDTVCSGVTGAANVAKGAIQGGDLTTSKSVLT  
GKTDAVSTGLTGAVKLAAGTVQGTGMDTTKTVLTGKTDAVCSGVTGAANVAKGAVQMGVDT  
AKTVLTGKTDTVCSGVTGAANVAKGAVQGTGLKTTQNIATGKTNTLGSAGVTGAANVAKGAV  
QGGDLTTSKSVLTGKTDAVSTGLTGAVNLAAGTVQGTGVDTSKTDLTGTGKDTVCSGVTGAVN  
VAKGTVQGTGVDATAKTVLSGAKDAVTTGVTGAVNVAAGTVQGTGVDASKAVLMGKDTVFSG  
VTGAMSAKGAAGVQGGDLTTKTVLTGKTDAVSAAGLMGSGNVATGATHTGLSTFQNLWPSTP  
ATSWGGGLTSSRTTAQLAASQPGPKVLSAEQGSYFVRLGDLGPSFRQRAFEHAVSHLQHGQ  
FQARDTLAQLQDCFRLEKAQQAPEGQPRLDQSGASAEADAQVQERVCGLLRQLHTAYSG  
LVSSLQGLPAELQQPVGRARHSLCELYGIVASAGSVEELPAERLVQSRGVHQAWQGLEQ  
LLEGLQHNPPLSWLVGPFALPAGGQ

The full amino acid sequence of the protein of the invention was found to have 721 of 1199 amino acid residues (60%) identical to, and 898 of 1199 amino acid residues (74%) similar to, the 1403 amino acid residue ptnr:SPTREMBL-ACC:O88492 protein from Mus musculus (Mouse) (S3-12).

In a search of public sequence databases, NOV19 was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 19C.

**Table 19C. BLASTP results for NOV19**

Gene Index/ Identifier	Protein/Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SPTREMBL- ACC:Q96Q06	KIAA1881 PROTEIN - Homo sapiens	1348	875/993 (88%)	922/993 (92%)	0.0
ptnr:SPTREMBL- ACC:O88492	S3-12 - Mus musculus	1403	721/1199 (60%)	898/1199 (74%)	0.0
ptnr:SPTREMBL- ACC:Q98MG7	HYPOTHETICAL GLYCINE- RICH PROTEIN MLR0587 - Rhizobium loti (Mesorhizobium loti)	3145	361/969 (37%)	406/969 (41%)	7.9e-74
ptnr:SPTREMBL- ACC:Q98MG8	HYPOTHETICAL GLYCINE- RICH PROTEIN MLR0585 - Rhizobium loti (Mesorhizobium loti)	2147	353/944 (37%)	401/944 (42%)	3.5e-69
ptnr:SPTREMBL- ACC:Q96WU8	HYPOTHETICAL 119.8 KDA PROTEIN - Schizosaccharomyces pombe (Fission yeast)	1195	248/844 (29%)	332/844 (39%)	1.0e-42

A multiple sequence alignment is shown in Table 19D, with the protein of the invention being shown on line one in a ClustalW analysis comparing the protein of the invention with related protein sequences shown in Table 19C.

**Table 19D. ClustalW Analysis of NOV19**

- 1) NOV19 CG55906-01 (SEQ ID NO:58)
- 2) Q96Q06 (SEQ ID NO:233)
- 3) O88492 (SEQ ID NO:234)

	10	20	30	40	50	60	70	80
NOV19	MSAPDECRDPPKPKGPPAPMO	TLGSSFFGSLPGFSSARNLV	VAHSS	VGARDLVCSKMSRKARDVSSG	VAS	VVDVA		
Q96Q06	MSAPDECRDPPKPKGPPAPMO	TLGSSFFGSLPGFSSARNLV	VAHSS	VGARDLVCSKMSRKARDVSSG	VAS	VVDVA		
O88492	MSAPDECRDPPKPKGPPAPMO	TLGSSFFGSLPGFSSARNLV	VAHSS	VGARDLVCSKMSRKARDVSSG	VAS	VVDVA		
	90	100	110	120	130	140	150	160
NOV19	KGIVCGGLDTRTSALTGTKEVSS	GVITGAMDMAKGA	VCGGLDTSKAVLTG	TKDVTSTGLTGAVN	VAKGT	VQAGV		
Q96Q06	KGIVCGGLDTRTSALTGTKEVSS	GVITGAMDMAKGA	VCGGLDTSKAVLTG	TKDVTSTGLTGAVN	VAKGT	VQAGV		
O88492	KGIVCGGLDTRTSALTGTKEVSS	GVITGAMDMAKGA	VCGGLDTSKAVLTG	TKDVTSTGLTGAVN	VAKGT	VQAGV		
	170	180	190	200	210	220	230	240
NOV19	TTKTVLTGKTDVTGVMGAVN	LAKGT	VQGTG	VTSKAVLTG	TKDAVSTGLTGAVN	VARGSIQ	TCVDT	SKTVLTG
Q96Q06	TTKTVLTGKTDVTGVMGAVN	LAKGT	VQGTG	VTSKAVLTG	TKDAVSTGLTGAVN	VARGSIQ	TCVDT	SKTVLTG
O88492	TTKTVLTGKTDVTGVMGAVN	LAKGT	VQGTG	VTSKAVLTG	TKDAVSTGLTGAVN	VARGSIQ	TCVDT	SKTVLTG
	250	260	270	280	290	300	310	320
NOV19	SGVTGAMN	VAKGT	IQGTG	VDT	SKTVLTG	TKD	TVCSG	VTGAMN
Q96Q06	SGVTGAMN	VAKGT	IQGTG	VDT	SKTVLTG	TKD	TVCSG	VTGAMN
O88492	SGVTGAMN	VAKGT	IQGTG	VDT	SKTVLTG	TKD	TVCSG	VTGAMN
	330	340	350	360	370	380	390	400
NOV19	QTGVD	TTKTVLTG	TKNTVCSG	VTGAVN	LAKGT	IQGGLD	TTKSMV	MGTKD
Q96Q06	QTGVD	TTKTVLTG	TKNTVCSG	VTGAVN	LAKGT	IQGGLD	TTKSMV	MGTKD
O88492	QTGVD	TTKTVLTG	TKNTVCSG	VTGAVN	LAKGT	IQGGLD	TTKSMV	MGTKD
	410	420	430	440	450	460	470	480
NOV19	KD	TVCSG	VTGAMN	LARGT	IQGTG	VDT	TKIVLTG	TKD
Q96Q06	KD	TVCSG	VTGAMN	LARGT	IQGTG	VDT	TKIVLTG	TKD
O88492	KD	TVCSG	VTGAMN	LARGT	IQGTG	VDT	TKIVLTG	TKD
	490	500	510	520	530	540	550	560
NOV19	AK	GT	VQ	GTG	VDT	TKIVLTG	TKD	TVCSG
Q96Q06	AK	GT	VQ	GTG	VDT	TKIVLTG	TKD	TVCSG
O88492	AK	GT	VQ	GTG	VDT	TKIVLTG	TKD	TVCSG
	570	580	590	600	610	620	630	640
NOV19	VL	TG	KD	TVT	TGL	VAVN	VAKGT	VQGTG

Q96Q06	VLTKGKDTVTGLVGAENVAKGTVQGTMDTTKTVLTGKDTIYSGVTSAVNVAKGAVTGLKTTQNIATGKTMTFGSGVT	
088492	VLTKGKDTVTGAGLGAENVAKGAAQGGEDTTKSVLMGKDTVTGGLTCAENVAKGTTCGSLDITKSVVMGKDTVTGGLT	
	650 660 670 680 690 700 710 720	
NOV19	SAVNVAKGAAQGTGVDFAKTVLTGKDTVTGGLGAVNVAKGTVCSTVDITTKTVLTGKDTVCSS	
Q96Q06	GAVNVAKGAVTGTGVDFAKTVLTGKDTVTGGLGAVNVAKGTVCSTVDITTKTVLTGKDTVCSSVTGAENVAKGAVTGTG	
088492	GAVNVAKGAVTGTGVDFAKTVLTGKDTVTGGLGAVNVAKGTTCGSLDITKSVLMGKDTVTGGLTCAENVAKGAAQGG	
	730 740 750 760 770 780 790 800	
NOV19	DTAKAVLTGKDTVCSSVTGAENVAKGAVTGLKTTQNIATGKTMTFGSGVTGAENVAKGAAQGGEDTTKSVLMG	
Q96Q06	DTAKAVLTGKDTVCSSVTGAENVAKGAVTGLKTTQNIATGKTMTFGSGVTGAENVAKGAAQGGEDTTKSVLMG	
088492	DTAKAVLTGKDTVCSSVTGAENVAKGAVTGLKTTQNIATGKTMTFGSGVTGAENVAKGAAQGGEDTTKSVLMG	
	810 820 830 840 850 860 870 880	
NOV19	STGLTGAVNLAKGTVQGTMDTTKTVLTGKDTVCSSVTGAENVAKGAVTGTGVDFAKTVLTGKDTVCSSVTGAENVAKG	
Q96Q06	STGLTGAVNLAKGTVQGTMDTTKTVLTGKDTVCSSVTGAENVAKGAVTGTGVDFAKTVLTGKDTVCSSVTGAENVAKG	
088492	STGLTGAVNLAKGTVQGTMDTTKTVLTGKDTVCSSVTGAENVAKGAVTGTGVDFAKTVLTGKDTVCSSVTGAENVAKG	
	890 900 910 920 930 940 950 960	
NOV19	VQGLDITKSVLMGKDTVTGGLTCAENVAKGAAQGGEDTTKSVLMGKDTVTGGLTCAENVAKGAAQGGEDTTKSVLMG	
Q96Q06	VQGLDITKSVLMGKDTVTGGLTCAENVAKGAAQGGEDTTKSVLMGKDTVTGGLTCAENVAKGAAQGGEDTTKSVLMG	
088492	VQGLDITKSVLMGKDTVTGGLTCAENVAKGAAQGGEDTTKSVLMGKDTVTGGLTCAENVAKGAAQGGEDTTKSVLMG	
	970 980 990 1000 1010 1020 1030 1040	
NOV19	TKDVTVCSSVTGAENVAKGTVQGTMDTTKTVLTGKDTVCSSVTGAENVAKGTVCSTVDITTKTVLTGKDTVCSS	
Q96Q06	TKDVTVCSSVTGAENVAKGTVQGTMDTTKTVLTGKDTVCSSVTGAENVAKGTVCSTVDITTKTVLTGKDTVCSS	
088492	TKDVTVCSSVTGAENVAKGTVQGTMDTTKTVLTGKDTVCSSVTGAENVAKGTVCSTVDITTKTVLTGKDTVCSS	
	1050 1060 1070 1080 1090 1100 1110 1120	
NOV19	MAKGAQGGGLDITTKTVLTGKDTVCSSVTGAENVAKGTVCSTVDITTKTVLTGKDTVCSSVTGAENVAKGTVCST	
Q96Q06	MAKGAQGGGLDITTKTVLTGKDTVCSSVTGAENVAKGTVCSTVDITTKTVLTGKDTVCSSVTGAENVAKGTVCST	
088492	MAKGAQGGGLDITTKTVLTGKDTVCSSVTGAENVAKGTVCSTVDITTKTVLTGKDTVCSSVTGAENVAKGTVCST	
	1130 1140 1150 1160 1170 1180 1190 1200	
NOV19	VATGATHGLSTFQNWLPSTPATSNGLTSSRTITDNGGEQTALSPQAPFSGISTPPVLSVCPPEPAWFAATITKGLAND	
Q96Q06	VATGATHGLSTFQNWLPSTPATSNGLTSSRTITDNGGEQTALSPQAPFSGISTPPVLSVCPPEPAWFAATITKGLAND	
088492	VATGATHGLSTFQNWLPSTPATSNGLTSSRTITDNGGEQTALSPQAPFSGISTPPVLSVCPPEPAWFAATITKGLAND	
	1210 1220 1230 1240 1250 1260 1270 1280	
NOV19	MASSACATRSVTECCQAAATG-----PAAPPEELKGLGDIPOPTTBEQAQLAVSISGKRVLSAEGSYKTRLGDLA	
Q96Q06	MASSACATRSVTECCQAAATG-----PAAPPEELKGLGDIPOPTTBEQAQLAVSISGKRVLSAEGSYKTRLGDLA	
088492	MASSACATRSVTECCQAAATG-----PAAPPEELKGLGDIPOPTTBEQAQLAVSISGKRVLSAEGSYKTRLGDLA	
	1290 1300 1310 1320 1330 1340 1350 1360	
NOV19	PSFRORAFEHAVSHLQHQGFQARTDLAQLQDCFRLLIEKAQQAPEGQPRLDQSGSASAEADAQVQ-----RVCGLLRC	
Q96Q06	PSFRORAFEHAVSHLQHQGFQARTDLAQLQDCFRLLIEKAQQAPEGQPRLDQSGSASAEADAQVQ-----RVCGLLRC	
088492	PSFRORAFEHAVSHLQHQGFQARTDLAQLQDCFRLLIEKAQQAPEGQPRLDQSGSASAEADAQVQ-----RVCGLLRC	
	1370 1380 1390 1400 1410 1420 1430 1440	
NOV19	LHTAYSSGLVSSLQGLPAELQPPVGRARHSLCELYGIVASAGSVEELPAERLVQSRGVHQAQGLEQLLEGLOHNPPLSW	
Q96Q06	LHTAYSSGLVSSLQGLPAELQPPVGRARHSLCELYGIVASAGSVEELPAERLVQSRGVHQAQGLEQLLEGLOHNPPLSW	
088492	LHTAYSSGLVSSLQGLPAELQPPVGRARHSLCELYGIVASAGSVEELPAERLVQSRGVHQAQGLEQLLEGLOHNPPLSW	
	1450	
NOV19	LVGPFALPAGGQ	
Q96Q06	LVGPFALPAGGQ	
088492	LVGPFALPAGGQ	

Other BLAST results include sequences from the Patp database, which is a proprietary database that contains sequences published in patents and patent publications. Patp results include those listed in Table 19E.

Table 19E. Patp BLASTP Analysis for NOV19





```

NOV19 772 GAVQMGVDTAKTVLTGTKDTCVSGVTGAANVAKGAVQTgltkttnia 818
.....AkdakekkageaKDktgnkakekaeeaKdkasdakd
+++++ ++ ++|+ ||++ ++ + | ++|++ +||++|
819 tgtkntlgsgvtgAAKVAKGA-VQGGLD----TTKSVLTGTKDAVSTGLT 863

perilipin: domain 1 of 1, from 844 to 1209: score -20.1, E = 0.00018
(SEQ ID NO:239) matavedlpqgesVvd..RvasLPlVsstikcdlVsaaYdstKenyp
+|+ +| +++| +++ + | +| ++| +| +
NOV19 844 LDTTKSVLTGTKDAVStgLTGAVNLAkGT-----VQTGVDTSKTVLT 885

lvkGvksVceaaekGvetitsaAvtsaqPivkkLepqIavaneyackGLD
+ +|| ||++++| ++| + | +++|
886 G--TKDTCV----SGVTGAVNVAKGTVQ-----TGVDTAkTVLSGAKD 922

kLEeklPiLqqPpekivanaKgavtgakdavstrvesakdsVvqpilerv
++ +|+ ||| | +|| + + ||+| +++++
923 -----AVTTGVTGAVNVAKGTVQTVGDASKAVLMGTDKTVFSGVTGAM 965

DkvKgAvqagvEstKsvvtgsantVlgsrvqglassGVDt.aLgksEklv
|||||+|++ ||| |+ | + | ++|+ | |+| +
966 SMAKGAVQGGLDTTKTVLTGTKDAVSA---GLMGSGNVATgATHTGLSTF 1012

eqyLP.....pteeElekeAkkvegfdskkvqqqrqkp.sal
+ ||+++ ++ ++ +++| +|+ +++|+++ + +++++|++
1013 QNWLPstpatswggltsSRTTAQLA---ASQPGPKVLS-----AEQgSYF 1054

vrlgslSekLrrrrayqqalgrvraaKqrSqeaihqLqsvaeLietakkgv
||| | |+| ++|++ ++ + ++ +++||| ++|||+|++
1055 VRLGDLGPSFRQRAFEHAVSHLQHGGFQARDTLAQLQDCFRLIEKAQQAP 1104

sqanqkvsraqdkLyvlWlewkassgedpedesdtepeqiEsri111.tr
|++ ++ | ++ ++
1105 EGQPR-----LDQGS--GASAEDAQVQErVC 1128

elaqqglvaalktlssigqipnldtvqqvgmsgdaysafrsraasfk
|++| +| +|+||+||| ||| +++ + ++| +| |
1129 GLLRQLHTAYSGLVSSLQGLPAELQQPVGRARHSLCELYGIVAS-AGSVE 1177

etsdgl1tsskgrvaslkealdevmDyVVsnt<-*
|+++ | +|++ | + +| + + |
1178 ELPAERLVQSREGVHQAWQGLEQLLEGLQHNP 1209

```

The S3-12 disclosed in this invention is expressed in at least the following tissues: colon, lung. In addition, the sequence is predicted to be expressed in the following tissues because of the expression pattern of (GENBANK-ID: gb:GENBANK-

- 5 ID:AF064748|acc:AF064748.1) a closely related *Mus musculus* S3-12 mRNA, complete cds homolog in species *Mus musculus* adipocytes.

The nucleic acids and proteins of the invention are useful in potential diagnostic and therapeutic applications implicated in various diseases and disorders described below and/or other pathologies. For example, the compositions of the present invention will have efficacy for treatment of patients suffering from: cancer, trauma, regeneration (in vitro and in vivo), viral/bacterial/parasitic infections, Hirschsprung's disease, Crohn's Disease, appendicitis,

systemic lupus erythematosus, autoimmune disease, asthma, emphysema, scleroderma, allergy, ARDS and other diseases, disorders and conditions of the like.

This novel human protein has best homology to a novel mouse protein S3-12 cloned from mouse adipocytes using an antibody based subtractive hybridization protocol. It also contains tandem repeats of a threonine-rich 33-amino acid motif; which are similar to 33-amino acid motif in adipocyte differentiation-related protein (ADRP).

This sequence has 99% homology to a patented partial cDNA, Acc No A50242, that has been described as encoding an autoantigen diagnostic of endometriosis (see Y95851). These autoantigens (see Y95843-55) can be used in non-invasive assays to detect endometriosis. The assays are based on the binding of the autoantigens by autoantibodies in a body fluid of a patient. The autoantigens may be immobilized on solid supports and used in an immunoprecipitation assay, an enzyme linked immunosorbant assay (ELISA), a depletion enzyme-linked immunosorbant assay (dELISA), a Western blot, a particle agglutination assay, a luminescent oxygen-channeling immunoassay, a proximity-based immunosorbant assay and/or a biosensor-based immunoassay to detect the presence of autoantibodies immunospecific for them. The presence of such antibodies is indicative of the presence of endometriosis. High clinical sensitivity and specificity, as well as a means for assessing disease progression, prognosis and therapeutic efficacy, are achieved. Polynucleotides encoding the autoantigens can be used in the recombinant production of the autoantigens.

## NOV20

A disclosed NOV20 nucleic acid of 810 nucleotides (also referred to as CG55906-02) (SEQ ID NO:59) encoding a novel S3-12-like protein is shown in Table 20A. An open reading frame was identified beginning with an ATG initiation codon at nucleotides 123-125 and ending with a TGA codon at nucleotides 792-794. Putative untranslated regions upstream from the initiation codon and downstream from the termination codon are underlined. The start and stop codons are in bold in Table 20A.

**Table 20A. NOV20 nucleotide sequence (SEQ ID NO:59)**

AGGCCTGCAGGTGGGTGTCGGGCTGCTCAGGCTTTCAGTGGGGAGTGGGTGTGGGATGGG
AGGCTAGGGAACCCCATTCACGCACCTTCTCTGCCCCCTTCCAGCTTCTCACGTTCTCA
<u>CTATG</u> TCTGCTCCAGACGAAGGGAGACGGGATCCCCCAAACCGAAGGGCAAGACCCTGG
GCAGCTTCTTTGGGTCCCTGCCTGGCTTCAACTCTGCCCCGAACCTGGTGGCCAACGCAC
ATAGCTCGGCGAGAGCCCGGCCGCTGACCCACAGGAGCGCCTGCTGCCGAGGCTG
CCCAACCACAGGCTCAGGTGGCTGCCACCCAGAGCAGACGCCCCATGGACGAGAAGG
AGCTGCAACCTTCGGAAGATGAAAAGGCCAGCAGGCTCCAGAAGGGCAGCCACGTC

TGGACCAGGGCTCAGGTGCCAGTGCGGAGGACGCTGCTGTCCAGGAGGAGCGGGATGCCG  
 GGGTTCTGTCCAGGTCTGCGGCCTTCTCCGGCAGCTGCACACGGCCTACAGTGGCCTGG  
 TCTCCAGCCTCCGGGGCCTGCCCGCCGAGCTCCAGCAGCCAGTGGGGCGGGCGCGGCACA  
 GCCTCTGTGAGCTCTATGGCATCGTGGCCTCAGCTGGCTCTGTAGAGGAGCTGCCCCGAG  
 AGCGGCTGGTGCAGAGCCGCGAGGTGTGCACCAGGCTTGGCAGGGGTTAGAGCAGCTGC  
 TGGAGGGCCTACAGCACAAATCCCCCGCTCAGCTGGCTGGTAGGGCCCTTCGCCTTGCCCG  
 CTGGCGGGCAGTAGCTGTAGGAGCCTGCAG

The S3-12-like NOV20 gene disclosed in this invention maps to chromosome 19.

In a search of sequence databases, it was found, for example, that the nucleic acid sequence of this invention has 349 of 526 bases (66%) identical to a gb:GENBANK-ID:AF064748|acc:AF064748.1 mRNA from Mus musculus (Mus musculus S3-12 mRNA, complete cds).

A disclosed NOV20 polypeptide (SEQ ID NO:60) encoded by SEQ ID NO:59 has 223 amino acid residues and is presented in Table 20B using the one-letter code. The SignalP, Psort and/or Hydropathy results predict that NOV20 has no signal peptide and is likely to be localized in the cytoplasm with a certainty of 0.6500 predicted by PSORT. The protein of this invention may be membrane-associated, based on its homology to mouse S3-12 (Nat Biotechnol 1998 Jun;16(6):581-6). In an alternative embodiment, NOV20 is likely to be localized to the lysosome (lumen) with a certainty of 0.1916, or to the mitochondrial matrix space with a certainty of 0.1000.

**Table 20B. NOV20 protein sequence (SEQ ID NO:60)**

MSAPDEGRRDPPKPKGKTLGSFFGSLPGFNSARNLVANAHSSARARPAADPTGAPAAEAA  
 QPQAQVAAHPEQTAPWTEKELQPSKEIEKAQQAPEGQPRLDQSGGASAEAAVQEERDAG  
 VLSRVCGLLRQLHTAYSGLVSSLRGLPAELQQPVGRARHSLCELYGIVASAGSVEELPAE  
 RLVQSREGVHQAWQGLEQLLEGLQHNPPLSWLVGPFALPAGGQ

NOV19 and NOV20 are both members of the S3-12 protein family and have similar protein sequence at the N-terminus and C-terminus. The relationship between the NOV19 and NOV20 protein sequences is shown in Table 20C.

**Table 20C. ClustalW Alignment of NOV19 and NOV20**

	10	20	30	40	50	60	70	80
CG55906_01	MSAPDEGRRDPPKPKGKTLGSFFGSLPGFNSARNLVANAHSSARARPAADPTGAPAAEAA							
CG55906_02	MSAPDEGRRDPPKPKGKTLGSFFGSLPGFNSARNLVANAHSSARARPAADPTGAPAAEAA							
	90	100	110	120	130	140	150	160
CG55906_01	VQGGDLTTRSAITGTRVSSGVTGAMDMAGAVQGGDLTSKAVLTGTDVSTGLTGAVNVAKGTQAGVDTTRKTVLTG							
CG55906_02	VQGGDLTTRSAITGTRVSSGVTGAMDMAGAVQGGDLTSKAVLTGTDVSTGLTGAVNVAKGTQAGVDTTRKTVLTG							
	170	180	190	200	210	220	230	240

CG55906_01	TKDTVTITGVMGAVNLAKGTVQTGVETSKAVLTGTFKDAVSTGLTGAVNVARGSIQTGVDTSTKTLTGTKDTCVSGVTGAMN
CG55906_02	-----
	250 260 270 280 290 300 310 320
CG55906_01	VAKGTIQTGVDTSTKTLTGTKDTCVSGVTGAMNVAKGTIQTGVDTSTKTLTGTKDTCVSGVTGAMNVAKGTIQTGVDTTK
CG55906_02	-----
	330 340 350 360 370 380 390 400
CG55906_01	TVLTGKNTVCVSGVTGAVNLAKEAIQGGLDTTKSMVMGTDKTMSTGLTGAANVAKGAMQTLNTTQNIATGTDTCVSGV
CG55906_02	-----
	410 420 430 440 450 460 470 480
CG55906_01	TGAMNLRAGTQTGVDTTKIVLTGKDTVCVSGVTGAANVAKGAVQGGLDTTKSVLTGKDAVSTGLTGAVNVAKGTVQGTG
CG55906_02	-----TGAP-----
	490 500 510 520 530 540 550 560
CG55906_01	VDITKTIVLTGKDTVCVSGVTSAVNVAKGAVQGGLDTTKSVVIGTKDITMSTGLTGAANVAKGAVQGVDTAKTVLTGKDT
CG55906_02	-----
	570 580 590 600 610 620 630 640
CG55906_01	VTGLVGAVNVAKGTVQGTMDTTKTVLTGKDTIYSGVTSAVNVAKGAVQGLKTTQNIATGKNTFGSGVTSAVNVAKG
CG55906_02	-----
	650 660 670 680 690 700 710 720
CG55906_01	AAQTGVDTAKTVLTGKDTVTGLMGAVNVAKGTVQTSVDTTKTVLTGKDTVCVSGVTGAANVAKGAVQGGLDTTKSVLT
CG55906_02	-----NABNAG-----
	730 740 750 760 770 780 790 800
CG55906_01	GTKDAVSTGLTGAVNLAKEAIQGGLDTTKSMVMGTDKTMSTGLTGAANVAKGAVQGGLDTTKSVLTGKDAVSTGLTGAVNVAKGTVQGTG
CG55906_02	-----p-----c-----a-----
	810 820 830 840 850 860 870 880
CG55906_01	NVAKGAVQGGLDTTKSVLTGKDAVSTGLTGAVNLAKEAIQGGLDTTKSMVMGTDKTMSTGLTGAANVAKGAVQGGLDTTKSVLT
CG55906_02	-----QVAHAPEQT-----
	890 900 910 920 930 940 950 960
CG55906_01	KTVLTGKDTVCVSGVTGAVNVAKGTVQGTMDTTKTVLTGKDTIYSGVTSAVNVAKGAVQGLKTTQNIATGKNTFGSGVTSAVNVAKG
CG55906_02	-----
	970 980 990 1000 1010 1020 1030 1040
CG55906_01	VTGAMSMKAGAVQGGLDTTKTVLTGKDAVSTGLTGAVNVAKGAVQGGLDTTKSVLTGKDAVSTGLTGAVNVAKGTVQGTG
CG55906_02	-----A-----N-----TEKEL-----
	1050 1060 1070 1080 1090 1100 1110 1120
CG55906_01	FGPKVLSAEQGSYFVRLGDLGPFQRQAFHNAVSHLQHGQFQARDITLAQLQDCFRLEKAQQAPEGQPRLDQSGSASAE
CG55906_02	-----PS-----LEKAQQAPEGQPRLDQSGSASAE
	1130 1140 1150 1160 1170 1180 1190 1200
CG55906_01	AAVQE-----RVCGLLRQLHTAYSGLVSSLRGLPAELQQPVGRARHSLCELYGIVASAGSVEELPAERLVQSREGV
CG55906_02	AAVQERDAGVLSRVCGLLRQLHTAYSGLVSSLRGLPAELQQPVGRARHSLCELYGIVASAGSVEELPAERLVQSREGV
	1210 1220 1230
CG55906_01	QAWQGLEQLLEGLQHNPPPLSWLVGPPFALPAGGQ
CG55906_02	QAWQGLEQLLEGLQHNPPPLSWLVGPPFALPAGGQ

The full amino acid sequence of the NOV20 protein of the invention was found to have 75 of 142 amino acid residues (52%) identical to, and 94 of 142 amino acid residues (66%) similar to, the 1403 amino acid residue ptrn:SPTREMBL-ACC:O88492 protein from *Mus musculus* (Mouse) (S3-12).

In a search of public sequence databases, NOV20 was found to have homology to the amino acid sequences shown in the BLASTP data listed in Table 20D.

**Table 20D. BLASTP results for NOV20**

Gene Index/ Identifier	Protein/Organism	Length (aa)	Identity (%)	Positives (%)	Expect
ptnr:SPTREMBL- ACC:Q96Q06	KIAA1881 PROTEIN - Homo sapiens	1348	141/156 (90%)	145/156 (92%)	1.6e-67
ptnr:SPTREMBL- ACC:O88492	S3-12 - Mus musculus	1403	75/142 (52%)	94/142 (66%)	9.9e-28
ptnr:SWISSPROT- ACC:O60664	Cargo selection protein TIP47 (47 kDa mannose 6-phosphate receptor- binding protein) (47 kDa MPR- binding protein) (Placental protein 17) - Homo sapiens	434	55/197 (27%)	95/197 (48%)	3.5e-10
ptnr:SPTREMBL- ACC:Q9BS03	CARGO SELECTION PROTEIN (MANNOSE 6 PHOSPHATE RECEPTOR BINDING PROTEIN) - Homo sapiens	434	55/197 (27%)	95/197 (48%)	3.5e-10
ptnr:SPTREMBL- ACC:Q9DBG5	1300012C15RIK PROTEIN (RIKEN CDNA 1300012C15 GENE) - Mus musculus	437	46/145 (31%)	75/145 (51%)	2.4e-09

- 5 A multiple sequence alignment is shown in Table 20E, with the proteins of the invention being shown on lines one and two in a ClustalW analysis comparing the protein of the invention with related protein sequences shown in Table 20D.

**Table 20E. ClustalW Analysis of NOV20**

1)	NOV20	CG55906-02	(SEQ ID NO:60)
2)	Q96Q06		(SEQ ID NO:240)
3)	O88492		(SEQ ID NO:241)

	10	20	30	40	50	60	70	80
NOV20	.....	.....	.....	.....	.....	.....	.....	.....
Q96Q06	.....	.....	.....	.....	.....	.....	.....	.....
O88492	MSASGDGTRVPPKSKGKTLSSFFGSLPGFSSARNLVSHTHSSTSTKDLQTTDTPSGTTPFSSKVSINSONAGDAGAGLCP							
	90	100	110	120	130	140	150	160
NOV20	.....	.....	.....	.....	.....	.....	.....	.....
Q96Q06	GLDITRSALTG-----TKKAVSSGVTCAMDMAKCAVQGGLDTSKAVLTGKTKTVSTGHTGAVNVAKGTVQAGVDTKPTVL							
O88492	SEQTAGDKDMGFSFVTSSEDAFSGVFCHMDAAKGMVQGGIGANQSAIVGTRKAVSSGVYMGAVGVAKGLVKGGLDTSKRVYL							
	170	180	190	200	210	220	230	240
NOV20	.....	.....	.....	.....	.....	.....	.....	.....
Q96Q06	CTKDTVTITGVMGAVNAKGTVOICGKTSKAVHTGKDAVSTGLTCAVNVAKGSIQICGDTSKAVHTSTKDTTCSSVTSF							
O88492	NTKDTVTITGVMGAVNAKGTVOICGKTSKAVHTGKDAVSTGLTCAVNVAKGSIQICGDTSKAVHTSTKDTTCSSVTSF							
	250	260	270	280	290	300	310	320
NOV20	.....	.....	.....	.....	.....	.....	.....	.....
Q96Q06	MNVAKGTVCTGCDTSKAVLTGKDTVCSGGTGAANNVAKGTHTGCDTSKTVLTGKDTVCSGGTGAANNVAKGTHTGCDTSK							
O88492	ANVAKGTVCTGCDTSKAVLTGKDTVCSGGTGAANNVAKGTHTGCDTSKTVLTGKDTVCSGGTGAANNVAKGTHTGCDTSK							
	330	340	350	360	370	380	390	400
NOV20	.....	.....	.....	.....	.....	.....	.....	.....
Q96Q06	TKSVLTGKTVITGCTGAVNVAKCAVQGGLDITKSVVMGTDKDTSTGLTGAANNVAKGAMCTGLNTTNTNLTATGKDTVCS							
O88492	TKSVLTGKTVITGCTGAVNVAKCAVQGGLDITKSVVMGTDKDTSTGLTGAANNVAKGAMCTGLNTTNTNLTATGKDTVCS							
	410	420	430	440	450	460	470	480



Table 20F. Patp BLASTP Analysis for NOV20					
Sequences producing High-scoring Segment Pairs	Protein/Organism	Length (aa)	Identity (%)	Positive (%)	E Value
patp:AAY48492	Human breast tumour-associated protein 37 - Homo sapiens	324	141/156 (90%)	145/156 (92%)	1.0e-68
patp:AAY44929	Human adipose differentiation associated protein-1 - Homo sapiens	213	141/156 (90%)	145/156 (92%)	1.0e-68
patp:AAY44930	Human adipose differentiation associated protein-2 - Homo sapiens	206	141/156 (90%)	145/156 (92%)	1.0e-68
patp:AAY44931	Mammalian adipose differentiation associated protein - Mammalia	286	141/156 (90%)	145/156 (92%)	1.0e-68
patp:AAY67240	Human adipophilin-like protein (HALP) amino acid sequence - Homo sapiens	434	55/197 (27%)	95/197 (48%)	2.7e-10

Table 20G lists the domain description from DOMAIN analysis results against NOV20.

Table 20F. Domain Analysis of NOV20							
<b>Pfam analysis</b>							
Model	Domain	seq-f	seq-t	hmm-f	hmm-t	score	E-value
-----	-----	-----	-----	-----	-----	-----	-----
[no hits above thresholds]							
<b>No significant domains were found.</b>							

5 The S3-12-like gene disclosed in this invention is expressed in at least the following tissues: adrenal gland, bone marrow, brain - amygdala, brain - cerebellum, brain - hippocampus, brain - substantia nigra, brain - thalamus, brain -whole, fetal brain, fetal kidney, fetal liver, fetal lung, heart, kidney, lymphoma - Raji, mammary gland, pancreas, pituitary gland, placenta, prostate, salivary gland, skeletal muscle, small intestine, spinal cord, spleen, stomach, testis, thyroid, trachea, uterus, liver.

The sequence is predicted to be expressed in adipocytes because of the expression pattern of (GENBANK-ID: gb:GENBANK-ID:AF064748|acc:AF064748.1) a closely related Mus musculus S3-12 mRNA, complete cds homolog in species Mus musculus.

15 The nucleic acids and proteins of the invention have applications in the diagnosis and/or treatment of various diseases and disorders. For example, the compositions of the

present invention may have efficacy for the treatment of patients suffering from obesity as well as other diseases, disorders and conditions. This novel human protein has best homology to a novel mouse protein S3-12 cloned from mouse adipocytes using an antibody based subtractive hybridization protocol. S3-12 contains tandem repeats of a threonine-rich 33-amino acid motif; which are similar to 33-amino acid motif in adipocyte differentiation-related protein (ADRP). Therefore the protein of this invention may be useful in the treatment of obesity and its complications, such as hypertension, diabetes.

This novel human protein has best homology to a novel mouse protein S3-12 cloned from mouse adipocytes using an antibody based subtractive hybridization protocol. It also contains tandem repeats of a threonine-rich 33-amino acid motif; which are similar to 33-amino acid motif in adipocyte differentiation-related protein (ADRP).

This sequence has 99% homology to a patented partial cDNA, Acc No A50242, that has been described as encoding an autoantigen diagnostic of endometriosis (see Y95851). These autoantigens (see Y95843-55) can be used in non-invasive assays to detect endometriosis. The assays are based on the binding of the autoantigens by autoantibodies in a body fluid of a patient. The autoantigens may be immobilized on solid supports and used in an immunoprecipitation assay, an enzyme linked immunosorbant assay (ELISA), a depletion enzyme-linked immunosorbant assay (dELISA), a Western blot, a particle agglutination assay, a luminescent oxygen-channeling immunoassay, a proximity-based immunosorbant assay and/or a biosensor-based immunoassay to detect the presence of autoantibodies immunospecific for them. The presence of such antibodies is indicative of the presence of endometriosis. High clinical sensitivity and specificity, as well as a means for assessing disease progression, prognosis and therapeutic efficacy, are achieved. Polynucleotides encoding the autoantigens can be used in the recombinant production of the autoantigens.

## **NOVX Nucleic Acids and Polypeptides**

One aspect of the invention pertains to isolated nucleic acid molecules that encode NOVX polypeptides or biologically active portions thereof. Also included in the invention are nucleic acid fragments sufficient for use as hybridization probes to identify NOVX-encoding nucleic acids (*e.g.*, NOVX mRNAs) and fragments for use as PCR primers for the amplification and/or mutation of NOVX nucleic acid molecules. As used herein, the term "nucleic acid molecule" is intended to include DNA molecules (*e.g.*, cDNA or genomic DNA), RNA molecules (*e.g.*, mRNA), analogs of the DNA or RNA generated using nucleotide analogs, and derivatives, fragments and homologs thereof. The nucleic acid



molecule may be single-stranded or double-stranded, but preferably is comprised double-stranded DNA.

An NOVX nucleic acid can encode a mature NOVX polypeptide. As used herein, a “mature” form of a polypeptide or protein disclosed in the present invention is the product of a naturally occurring polypeptide or precursor form or proprotein. The naturally occurring polypeptide, precursor or proprotein includes, by way of nonlimiting example, the full-length gene product, encoded by the corresponding gene. Alternatively, it may be defined as the polypeptide, precursor or proprotein encoded by an ORF described herein. The product “mature” form arises, again by way of nonlimiting example, as a result of one or more naturally occurring processing steps as they may take place within the cell, or host cell, in which the gene product arises. Examples of such processing steps leading to a “mature” form of a polypeptide or protein include the cleavage of the N-terminal methionine residue encoded by the initiation codon of an ORF, or the proteolytic cleavage of a signal peptide or leader sequence. Thus a mature form arising from a precursor polypeptide or protein that has residues 1 to N, where residue 1 is the N-terminal methionine, would have residues 2 through N remaining after removal of the N-terminal methionine. Alternatively, a mature form arising from a precursor polypeptide or protein having residues 1 to N, in which an N-terminal signal sequence from residue 1 to residue M is cleaved, would have the residues from residue M+1 to residue N remaining. Further as used herein, a “mature” form of a polypeptide or protein may arise from a step of post-translational modification other than a proteolytic cleavage event. Such additional processes include, by way of non-limiting example, glycosylation, myristoylation or phosphorylation. In general, a mature polypeptide or protein may result from the operation of only one of these processes, or a combination of any of them. The term “probes”, as utilized herein, refers to nucleic acid sequences of variable length, preferably between at least about 10 nucleotides (nt), 100 nt, or as many as approximately, *e.g.*, 6,000 nt, depending upon the specific use. Probes are used in the detection of identical, similar, or complementary nucleic acid sequences. Longer length probes are generally obtained from a natural or recombinant source, are highly specific, and much slower to hybridize than shorter-length oligomer probes. Probes may be single- or double-stranded and designed to have specificity in PCR, membrane-based hybridization technologies, or ELISA-like technologies.

The term “isolated” nucleic acid molecule, as utilized herein, is one, which is separated from other nucleic acid molecules which are present in the natural source of the nucleic acid. Preferably, an “isolated” nucleic acid is free of sequences which naturally flank the nucleic

acid (*i.e.*, sequences located at the 5'- and 3'-termini of the nucleic acid) in the genomic DNA of the organism from which the nucleic acid is derived. For example, in various embodiments, the isolated NOVX nucleic acid molecules can contain less than about 5 kb, 4 kb, 3 kb, 2 kb, 1 kb, 0.5 kb or 0.1 kb of nucleotide sequences which naturally flank the nucleic acid molecule in genomic DNA of the cell/tissue from which the nucleic acid is derived (*e.g.*, brain, heart, liver, spleen, etc.). Moreover, an "isolated" nucleic acid molecule, such as a cDNA molecule, can be substantially free of other cellular material or culture medium when produced by recombinant techniques, or of chemical precursors or other chemicals when chemically synthesized.

10 A nucleic acid molecule of the invention, *e.g.*, a nucleic acid molecule having the nucleotide sequence SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, or a complement of this aforementioned nucleotide sequence, can be isolated using standard molecular biology techniques and the sequence information provided herein. Using all or a portion of the nucleic acid sequence of  
15 SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59 as a hybridization probe, NOVX molecules can be isolated using standard hybridization and cloning techniques (*e.g.*, as described in Sambrook, *et al.*, (eds.), MOLECULAR CLONING: A LABORATORY MANUAL 2<sup>nd</sup> Ed., Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY, 1989; and Ausubel, *et al.*, (eds.), CURRENT PROTOCOLS IN  
20 MOLECULAR BIOLOGY, John Wiley & Sons, New York, NY, 1993.)

A nucleic acid of the invention can be amplified using cDNA, mRNA or alternatively, genomic DNA, as a template and appropriate oligonucleotide primers according to standard PCR amplification techniques. The nucleic acid so amplified can be cloned into an appropriate vector and characterized by DNA sequence analysis. Furthermore,  
25 oligonucleotides corresponding to NOVX nucleotide sequences can be prepared by standard synthetic techniques, *e.g.*, using an automated DNA synthesizer.

As used herein, the term "oligonucleotide" refers to a series of linked nucleotide residues, which oligonucleotide has a sufficient number of nucleotide bases to be used in a PCR reaction. A short oligonucleotide sequence may be based on, or designed from, a  
30 genomic or cDNA sequence and is used to amplify, confirm, or reveal the presence of an identical, similar or complementary DNA or RNA in a particular cell or tissue. Oligonucleotides comprise portions of a nucleic acid sequence having about 10 nt, 50 nt, or 100 nt in length, preferably about 15 nt to 30 nt in length. In one embodiment of the invention, an oligonucleotide comprising a nucleic acid molecule less than 100 nt in length

would further comprise at least 6 contiguous nucleotides SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, or a complement thereof. Oligonucleotides may be chemically synthesized and may also be used as probes.

- 5 In another embodiment, an isolated nucleic acid molecule of the invention comprises a nucleic acid molecule that is a complement of the nucleotide sequence shown in SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, or a portion of this nucleotide sequence (*e.g.*, a fragment that can be used as a probe or primer or a fragment encoding a biologically-active portion of an NOVX polypeptide). A
- 10 nucleic acid molecule that is complementary to the nucleotide sequence shown SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, or 59 is one that is sufficiently complementary to the nucleotide sequence shown SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, or 59 that it can hydrogen bond with little or no mismatches to the
- 15 nucleotide sequence shown SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, or 59, thereby forming a stable duplex.

- As used herein, the term “complementary” refers to Watson-Crick or Hoogsteen base pairing between nucleotides units of a nucleic acid molecule, and the term “binding” means the physical or chemical interaction between two polypeptides or compounds or associated
- 20 polypeptides or compounds or combinations thereof. Binding includes ionic, non-ionic, van der Waals, hydrophobic interactions, and the like. A physical interaction can be either direct or indirect. Indirect interactions may be through or due to the effects of another polypeptide or compound. Direct binding refers to interactions that do not take place through, or due to, the effect of another polypeptide or compound, but instead are without other substantial chemical
- 25 intermediates.

- Fragments provided herein are defined as sequences of at least 6 (contiguous) nucleic acids or at least 4 (contiguous) amino acids, a length sufficient to allow for specific hybridization in the case of nucleic acids or for specific recognition of an epitope in the case of amino acids, respectively, and are at most some portion less than a full length sequence.
- 30 Fragments may be derived from any contiguous portion of a nucleic acid or amino acid sequence of choice. Derivatives are nucleic acid sequences or amino acid sequences formed from the native compounds either directly or by modification or partial substitution. Analogs are nucleic acid sequences or amino acid sequences that have a structure similar to, but not identical to, the native compound but differs from it in respect to certain components or side

chains. Analogs may be synthetic or from a different evolutionary origin and may have a similar or opposite metabolic activity compared to wild type. Homologs are nucleic acid sequences or amino acid sequences of a particular gene that are derived from different species. Derivatives and analogs may be full length or other than full length, if the derivative or analog contains a modified nucleic acid or amino acid, as described below. Derivatives or analogs of the nucleic acids or proteins of the invention include, but are not limited to, molecules comprising regions that are substantially homologous to the nucleic acids or proteins of the invention, in various embodiments, by at least about 70%, 80%, or 95% identity (with a preferred identity of 80-95%) over a nucleic acid or amino acid sequence of identical size or when compared to an aligned sequence in which the alignment is done by a computer homology program known in the art, or whose encoding nucleic acid is capable of hybridizing to the complement of a sequence encoding the aforementioned proteins under stringent, moderately stringent, or low stringent conditions. *See e.g.* Ausubel, *et al.*, CURRENT PROTOCOLS IN MOLECULAR BIOLOGY, John Wiley & Sons, New York, NY, 1993, and below.

A "homologous nucleic acid sequence" or "homologous amino acid sequence," or variations thereof, refer to sequences characterized by a homology at the nucleotide level or amino acid level as discussed above. Homologous nucleotide sequences encode those sequences coding for isoforms of NOVX polypeptides. Isoforms can be expressed in different tissues of the same organism as a result of, for example, alternative splicing of RNA. Alternatively, isoforms can be encoded by different genes. In the invention, homologous nucleotide sequences include nucleotide sequences encoding for an NOVX polypeptide of species other than humans, including, but not limited to: vertebrates, and thus can include, *e.g.*, frog, mouse, rat, rabbit, dog, cat, cow, horse, and other organisms. Homologous nucleotide sequences also include, but are not limited to, naturally occurring allelic variations and mutations of the nucleotide sequences set forth herein. A homologous nucleotide sequence does not, however, include the exact nucleotide sequence encoding human NOVX protein. Homologous nucleic acid sequences include those nucleic acid sequences that encode conservative amino acid substitutions (see below) in SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, as well as a polypeptide possessing NOVX biological activity. Various biological activities of the NOVX proteins are described below.

An NOVX polypeptide is encoded by the open reading frame ("ORF") of an NOVX nucleic acid. An ORF corresponds to a nucleotide sequence that could potentially be translated into a polypeptide. A stretch of nucleic acids comprising an ORF is uninterrupted by a stop

codon. An ORF that represents the coding sequence for a full protein begins with an ATG "start" codon and terminates with one of the three "stop" codons, namely, TAA, TAG, or TGA. For the purposes of this invention, an ORF may be any part of a coding sequence, with or without a start codon, a stop codon, or both. For an ORF to be considered as a good candidate for coding for a *bona fide* cellular protein, a minimum size requirement is often set, e.g., a stretch of DNA that would encode a protein of 50 amino acids or more.

The nucleotide sequences determined from the cloning of the human NOVX genes allows for the generation of probes and primers designed for use in identifying and/or cloning NOVX homologues in other cell types, e.g. from other tissues, as well as NOVX homologues from other vertebrates. The probe/primer typically comprises substantially purified oligonucleotide. The oligonucleotide typically comprises a region of nucleotide sequence that hybridizes under stringent conditions to at least about 12, 25, 50, 100, 150, 200, 250, 300, 350 or 400 consecutive sense strand nucleotide sequence SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, or 59; or an anti-sense strand nucleotide sequence of SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, or 59; or of a naturally occurring mutant of SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59.

Probes based on the human NOVX nucleotide sequences can be used to detect transcripts or genomic sequences encoding the same or homologous proteins. In various embodiments, the probe further comprises a label group attached thereto, e.g. the label group can be a radioisotope, a fluorescent compound, an enzyme, or an enzyme co-factor. Such probes can be used as a part of a diagnostic test kit for identifying cells or tissues which mis-express an NOVX protein, such as by measuring a level of an NOVX-encoding nucleic acid in a sample of cells from a subject e.g., detecting NOVX mRNA levels or determining whether a genomic NOVX gene has been mutated or deleted.

"A polypeptide having a biologically-active portion of an NOVX polypeptide" refers to polypeptides exhibiting activity similar, but not necessarily identical to, an activity of a polypeptide of the invention, including mature forms, as measured in a particular biological assay, with or without dose dependency. A nucleic acid fragment encoding a "biologically-active portion of NOVX" can be prepared by isolating a portion SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, or 59, that encodes a polypeptide having an NOVX biological activity (the biological activities of the NOVX proteins are described below), expressing the encoded portion of NOVX protein (e.g.,

by recombinant expression *in vitro*) and assessing the activity of the encoded portion of NOVX.

### NOVX Nucleic Acid and Polypeptide Variants

The invention further encompasses nucleic acid molecules that differ from the nucleotide sequences shown in SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59 due to degeneracy of the genetic code and thus encode the same NOVX proteins as that encoded by the nucleotide sequences shown in SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59. In another embodiment, an isolated nucleic acid molecule of the invention has a nucleotide sequence encoding a protein having an amino acid sequence shown in SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60.

In addition to the human NOVX nucleotide sequences shown in SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, it will be appreciated by those skilled in the art that DNA sequence polymorphisms that lead to changes in the amino acid sequences of the NOVX polypeptides may exist within a population (*e.g.*, the human population). Such genetic polymorphism in the NOVX genes may exist among individuals within a population due to natural allelic variation. As used herein, the terms "gene" and "recombinant gene" refer to nucleic acid molecules comprising an open reading frame (ORF) encoding an NOVX protein, preferably a vertebrate NOVX protein. Such natural allelic variations can typically result in 1-5% variance in the nucleotide sequence of the NOVX genes. Any and all such nucleotide variations and resulting amino acid polymorphisms in the NOVX polypeptides, which are the result of natural allelic variation and that do not alter the functional activity of the NOVX polypeptides, are intended to be within the scope of the invention.

Moreover, nucleic acid molecules encoding NOVX proteins from other species, and thus that have a nucleotide sequence that differs from the human SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59 are intended to be within the scope of the invention. Nucleic acid molecules corresponding to natural allelic variants and homologues of the NOVX cDNAs of the invention can be isolated based on their homology to the human NOVX nucleic acids disclosed herein using the human cDNAs, or a portion thereof, as a hybridization probe according to standard hybridization techniques under stringent hybridization conditions.

Accordingly, in another embodiment, an isolated nucleic acid molecule of the invention is at least 6 nucleotides in length and hybridizes under stringent conditions to the nucleic acid molecule comprising the nucleotide sequence of SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59.

5 In another embodiment, the nucleic acid is at least 10, 25, 50, 100, 250, 500, 750, 1000, 1500, or 2000 or more nucleotides in length. In yet another embodiment, an isolated nucleic acid molecule of the invention hybridizes to the coding region. As used herein, the term "hybridizes under stringent conditions" is intended to describe conditions for hybridization and washing under which nucleotide sequences at least 60% homologous to each other typically  
10 remain hybridized to each other.

Homologs (*i.e.*, nucleic acids encoding NOVX proteins derived from species other than human) or other related sequences (*e.g.*, paralogs) can be obtained by low, moderate or high stringency hybridization with all or a portion of the particular human sequence as a probe using methods well known in the art for nucleic acid hybridization and cloning.

15 As used herein, the phrase "stringent hybridization conditions" refers to conditions under which a probe, primer or oligonucleotide will hybridize to its target sequence, but to no other sequences. Stringent conditions are sequence-dependent and will be different in different circumstances. Longer sequences hybridize specifically at higher temperatures than shorter sequences. Generally, stringent conditions are selected to be about 5 °C lower than the  
20 thermal melting point (T<sub>m</sub>) for the specific sequence at a defined ionic strength and pH. The T<sub>m</sub> is the temperature (under defined ionic strength, pH and nucleic acid concentration) at which 50% of the probes complementary to the target sequence hybridize to the target sequence at equilibrium. Since the target sequences are generally present at excess, at T<sub>m</sub>, 50% of the probes are occupied at equilibrium. Typically, stringent conditions will be those in  
25 which the salt concentration is less than about 1.0 M sodium ion, typically about 0.01 to 1.0 M sodium ion (or other salts) at pH 7.0 to 8.3 and the temperature is at least about 30°C for short probes, primers or oligonucleotides (*e.g.*, 10 nt to 50 nt) and at least about 60°C for longer probes, primers and oligonucleotides. Stringent conditions may also be achieved with the addition of destabilizing agents, such as formamide.

30 Stringent conditions are known to those skilled in the art and can be found in Ausubel, *et al.*, (eds.), CURRENT PROTOCOLS IN MOLECULAR BIOLOGY, John Wiley & Sons, N.Y. (1989), 6.3.1-6.3.6. Preferably, the conditions are such that sequences at least about 65%, 70%, 75%, 85%, 90%, 95%, 98%, or 99% homologous to each other typically remain hybridized to each other. A non-limiting example of stringent hybridization conditions are

hybridization in a high salt buffer comprising 6X SSC, 50 mM Tris-HCl (pH 7.5), 1 mM EDTA, 0.02% PVP, 0.02% Ficoll, 0.02% BSA, and 500 mg/ml denatured salmon sperm DNA at 65°C, followed by one or more washes in 0.2X SSC, 0.01% BSA at 50°C. An isolated nucleic acid molecule of the invention that hybridizes under stringent conditions to the sequences SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, corresponds to a naturally-occurring nucleic acid molecule. As used herein, a "naturally-occurring" nucleic acid molecule refers to an RNA or DNA molecule having a nucleotide sequence that occurs in nature (*e.g.*, encodes a natural protein).

In a second embodiment, a nucleic acid sequence that is hybridizable to the nucleic acid molecule comprising the nucleotide sequence of SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, or fragments, analogs or derivatives thereof, under conditions of moderate stringency is provided. A non-limiting example of moderate stringency hybridization conditions are hybridization in 6X SSC, 5X Denhardt's solution, 0.5% SDS and 100 mg/ml denatured salmon sperm DNA at 55°C, followed by one or more washes in 1X SSC, 0.1% SDS at 37°C. Other conditions of moderate stringency that may be used are well-known within the art. *See, e.g.*, Ausubel, *et al.* (eds.), 1993, CURRENT PROTOCOLS IN MOLECULAR BIOLOGY, John Wiley & Sons, NY, and Kriegler, 1990; GENE TRANSFER AND EXPRESSION, A LABORATORY MANUAL, Stockton Press, NY.

In a third embodiment, a nucleic acid that is hybridizable to the nucleic acid molecule comprising the nucleotide sequences SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, or fragments, analogs or derivatives thereof, under conditions of low stringency, is provided. A non-limiting example of low stringency hybridization conditions are hybridization in 35% formamide, 5X SSC, 50 mM Tris-HCl (pH 7.5), 5 mM EDTA, 0.02% PVP, 0.02% Ficoll, 0.2% BSA, 100 mg/ml denatured salmon sperm DNA, 10% (wt/vol) dextran sulfate at 40°C, followed by one or more washes in 2X SSC, 25 mM Tris-HCl (pH 7.4), 5 mM EDTA, and 0.1% SDS at 50°C. Other conditions of low stringency that may be used are well known in the art (*e.g.*, as employed for cross-species hybridizations). *See, e.g.*, Ausubel, *et al.* (eds.), 1993, CURRENT PROTOCOLS IN MOLECULAR BIOLOGY, John Wiley & Sons, NY, and Kriegler, 1990, GENE TRANSFER AND EXPRESSION, A LABORATORY MANUAL, Stockton Press, NY; Shilo and Weinberg, 1981. *Proc Natl Acad Sci USA* 78: 6789-6792.



## Conservative Mutations

In addition to naturally-occurring allelic variants of NOVX sequences that may exist in the population, the skilled artisan will further appreciate that changes can be introduced by mutation into the nucleotide sequences SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, thereby leading to changes in the amino acid sequences of the encoded NOVX proteins, without altering the functional ability of said NOVX proteins. For example, nucleotide substitutions leading to amino acid substitutions at "non-essential" amino acid residues can be made in the sequence SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60. A "non-essential" amino acid residue is a residue that can be altered from the wild-type sequences of the NOVX proteins without altering their biological activity, whereas an "essential" amino acid residue is required for such biological activity. For example, amino acid residues that are conserved among the NOVX proteins of the invention are predicted to be particularly non-amenable to alteration. Amino acids for which conservative substitutions can be made are well-known within the art.

Another aspect of the invention pertains to nucleic acid molecules encoding NOVX proteins that contain changes in amino acid residues that are not essential for activity. Such NOVX proteins differ in amino acid sequence from SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, and 60 yet retain biological activity. In one embodiment, the isolated nucleic acid molecule comprises a nucleotide sequence encoding a protein, wherein the protein comprises an amino acid sequence at least about 45% homologous to the amino acid sequences SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, and 60. Preferably, the protein encoded by the nucleic acid molecule is at least about 60% homologous to SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, and 60; more preferably at least about 70% homologous to SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60; still more preferably at least about 80% homologous to SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60; even more preferably at least about 90% homologous to SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60; and most preferably at least about 95% homologous to SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60.

An isolated nucleic acid molecule encoding an NOVX protein homologous to the protein of SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60 can be created by introducing one or more nucleotide substitutions, additions or deletions into the nucleotide sequence of SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, such that one or more amino acid substitutions, additions or deletions are introduced into the encoded protein.

Mutations can be introduced into SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59 by standard techniques, such as site-directed mutagenesis and PCR-mediated mutagenesis. Preferably, conservative amino acid substitutions are made at one or more predicted, non-essential amino acid residues. A "conservative amino acid substitution" is one in which the amino acid residue is replaced with an amino acid residue having a similar side chain. Families of amino acid residues having similar side chains have been defined within the art. These families include amino acids with basic side chains (*e.g.*, lysine, arginine, histidine), acidic side chains (*e.g.*, aspartic acid, glutamic acid), uncharged polar side chains (*e.g.*, glycine, asparagine, glutamine, serine, threonine, tyrosine, cysteine), nonpolar side chains (*e.g.*, alanine, valine, leucine, isoleucine, proline, phenylalanine, methionine, tryptophan), beta-branched side chains (*e.g.*, threonine, valine, isoleucine) and aromatic side chains (*e.g.*, tyrosine, phenylalanine, tryptophan, histidine). Thus, a predicted non-essential amino acid residue in the NOVX protein is replaced with another amino acid residue from the same side chain family. Alternatively, in another embodiment, mutations can be introduced randomly along all or part of an NOVX coding sequence, such as by saturation mutagenesis, and the resultant mutants can be screened for NOVX biological activity to identify mutants that retain activity. Following mutagenesis of SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, the encoded protein can be expressed by any recombinant technology known in the art and the activity of the protein can be determined.

The relatedness of amino acid families may also be determined based on side chain interactions. Substituted amino acids may be fully conserved "strong" residues or fully conserved "weak" residues. The "strong" group of conserved amino acid residues may be any one of the following groups: STA, NEQK, NHQK, NDEQ, QHRK, MILV, MILF, HY, FYW, wherein the single letter amino acid codes are grouped by those amino acids that may be substituted for each other. Likewise, the "weak" group of conserved residues may be any one

of the following: CSA, ATV, SAG, STNK, STPA, SGND, SNDEQK, NDEQHK, NEQHRK, VLIM, HFY, wherein the letters within each group represent the single letter amino acid code. In one embodiment, a mutant NOVX protein can be assayed for (i) the ability to form protein:protein interactions with other NOVX proteins, other cell-surface proteins, or biologically-active portions thereof, (ii) complex formation between a mutant NOVX protein and an NOVX ligand; or (iii) the ability of a mutant NOVX protein to bind to an intracellular target protein or biologically-active portion thereof; (e.g. avidin proteins).

In yet another embodiment, a mutant NOVX protein can be assayed for the ability to regulate a specific biological function (e.g., regulation of insulin release).

## 10 Antisense Nucleic Acids

Another aspect of the invention pertains to isolated antisense nucleic acid molecules that are hybridizable to or complementary to the nucleic acid molecule comprising the nucleotide sequence of SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, or fragments, analogs or derivatives thereof. An "antisense" nucleic acid comprises a nucleotide sequence that is complementary to a "sense" nucleic acid encoding a protein (e.g., complementary to the coding strand of a double-stranded cDNA molecule or complementary to an mRNA sequence). In specific aspects, antisense nucleic acid molecules are provided that comprise a sequence complementary to at least about 10, 25, 50, 100, 250 or 500 nucleotides or an entire NOVX coding strand, or to only a portion thereof. Nucleic acid molecules encoding fragments, homologs, derivatives and analogs of an NOVX protein of SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60, or antisense nucleic acids complementary to an NOVX nucleic acid sequence of SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, are additionally provided.

In one embodiment, an antisense nucleic acid molecule is antisense to a "coding region" of the coding strand of a nucleotide sequence encoding an NOVX protein. The term "coding region" refers to the region of the nucleotide sequence comprising codons which are translated into amino acid residues. In another embodiment, the antisense nucleic acid molecule is antisense to a "noncoding region" of the coding strand of a nucleotide sequence encoding the NOVX protein. The term "noncoding region" refers to 5' and 3' sequences which flank the coding region that are not translated into amino acids (i.e., also referred to as 5' and 3' untranslated regions).

Given the coding strand sequences encoding the NOVX protein disclosed herein, antisense nucleic acids of the invention can be designed according to the rules of Watson and Crick or Hoogsteen base pairing. The antisense nucleic acid molecule can be complementary to the entire coding region of NOVX mRNA, but more preferably is an oligonucleotide that is antisense to only a portion of the coding or noncoding region of NOVX mRNA. For example, the antisense oligonucleotide can be complementary to the region surrounding the translation start site of NOVX mRNA. An antisense oligonucleotide can be, for example, about 5, 10, 15, 20, 25, 30, 35, 40, 45 or 50 nucleotides in length. An antisense nucleic acid of the invention can be constructed using chemical synthesis or enzymatic ligation reactions using procedures known in the art. For example, an antisense nucleic acid (*e.g.*, an antisense oligonucleotide) can be chemically synthesized using naturally-occurring nucleotides or variously modified nucleotides designed to increase the biological stability of the molecules or to increase the physical stability of the duplex formed between the antisense and sense nucleic acids (*e.g.*, phosphorothioate derivatives and acridine substituted nucleotides can be used).

Examples of modified nucleotides that can be used to generate the antisense nucleic acid include: 5-fluorouracil, 5-bromouracil, 5-chlorouracil, 5-iodouracil, hypoxanthine, xanthine, 4-acetylcytosine, 5-(carboxyhydroxymethyl) uracil, 5-carboxymethylaminomethyl-2-thiouridine, 5-carboxymethylaminomethyluracil, dihydrouracil, beta-D-galactosylqueosine, inosine, N6-isopentenyladenine, 1-methylguanine, 1-methylinosine, 2,2-dimethylguanine, 2-methyladenine, 2-methylguanine, 3-methylcytosine, 5-methylcytosine, N6-adenine, 7-methylguanine, 5-methylaminomethyluracil, 5-methoxyaminomethyl-2-thiouracil, beta-D-mannosylqueosine, 5'-methoxycarboxymethyluracil, 5-methoxyuracil, 2-methylthio-N6-isopentenyladenine, uracil-5-oxyacetic acid (v), wybutoxosine, pseudouracil, queosine, 2-thiocytosine, 5-methyl-2-thiouracil, 2-thiouracil, 4-thiouracil, 5-methyluracil, uracil-5-oxyacetic acid methylester, uracil-5-oxyacetic acid (v), 5-methyl-2-thiouracil, 3-(3-amino-3-N-2-carboxypropyl) uracil, (acp3)w, and 2,6-diaminopurine. Alternatively, the antisense nucleic acid can be produced biologically using an expression vector into which a nucleic acid has been subcloned in an antisense orientation (*i.e.*, RNA transcribed from the inserted nucleic acid will be of an antisense orientation to a target nucleic acid of interest, described further in the following subsection).

The antisense nucleic acid molecules of the invention are typically administered to a subject or generated *in situ* such that they hybridize with or bind to cellular mRNA and/or genomic DNA encoding an NOVX protein to thereby inhibit expression of the protein (*e.g.*, by inhibiting transcription and/or translation). The hybridization can be by conventional

nucleotide complementarity to form a stable duplex, or, for example, in the case of an antisense nucleic acid molecule that binds to DNA duplexes, through specific interactions in the major groove of the double helix. An example of a route of administration of antisense nucleic acid molecules of the invention includes direct injection at a tissue site. Alternatively, antisense nucleic acid molecules can be modified to target selected cells and then administered systemically. For example, for systemic administration, antisense molecules can be modified such that they specifically bind to receptors or antigens expressed on a selected cell surface (e.g., by linking the antisense nucleic acid molecules to peptides or antibodies that bind to cell surface receptors or antigens). The antisense nucleic acid molecules can also be delivered to cells using the vectors described herein. To achieve sufficient nucleic acid molecules, vector constructs in which the antisense nucleic acid molecule is placed under the control of a strong pol II or pol III promoter are preferred.

In yet another embodiment, the antisense nucleic acid molecule of the invention is an  $\alpha$ -anomeric nucleic acid molecule. An  $\alpha$ -anomeric nucleic acid molecule forms specific double-stranded hybrids with complementary RNA in which, contrary to the usual  $\beta$ -units, the strands run parallel to each other. See, e.g., Gaultier, *et al.*, 1987. *Nucl. Acids Res.* 15: 6625-6641. The antisense nucleic acid molecule can also comprise a 2'-o-methylribonucleotide (See, e.g., Inoue, *et al.* 1987. *Nucl. Acids Res.* 15: 6131-6148) or a chimeric RNA-DNA analogue (See, e.g., Inoue, *et al.*, 1987. *FEBS Lett.* 215: 327-330).

## **Ribozymes and PNA Moieties**

Nucleic acid modifications include, by way of non-limiting example, modified bases, and nucleic acids whose sugar phosphate backbones are modified or derivatized. These modifications are carried out at least in part to enhance the chemical stability of the modified nucleic acid, such that they may be used, for example, as antisense binding nucleic acids in therapeutic applications in a subject.

In one embodiment, an antisense nucleic acid of the invention is a ribozyme. Ribozymes are catalytic RNA molecules with ribonuclease activity that are capable of cleaving a single-stranded nucleic acid, such as an mRNA, to which they have a complementary region. Thus, ribozymes (e.g., hammerhead ribozymes as described in Haselhoff and Gerlach 1988. *Nature* 334: 585-591) can be used to catalytically cleave NOVX mRNA transcripts to thereby inhibit translation of NOVX mRNA. A ribozyme having specificity for an NOVX-encoding nucleic acid can be designed based upon the nucleotide sequence of an NOVX cDNA disclosed herein (i.e., SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59). For

example, a derivative of a *Tetrahymena* L-19 IVS RNA can be constructed in which the nucleotide sequence of the active site is complementary to the nucleotide sequence to be cleaved in an NOVX-encoding mRNA. See, e.g., U.S. Patent 4,987,071 to Cech, *et al.* and U.S. Patent 5,116,742 to Cech, *et al.* NOVX mRNA can also be used to select a catalytic RNA having a specific ribonuclease activity from a pool of RNA molecules. See, e.g., Bartel *et al.*, (1993) *Science* 261:1411-1418.

Alternatively, NOVX gene expression can be inhibited by targeting nucleotide sequences complementary to the regulatory region of the NOVX nucleic acid (e.g., the NOVX promoter and/or enhancers) to form triple helical structures that prevent transcription of the NOVX gene in target cells. See, e.g., Helene, 1991. *Anticancer Drug Des.* 6: 569-84; Helene, *et al.* 1992. *Ann. N.Y. Acad. Sci.* 660: 27-36; Maher, 1992. *Bioassays* 14: 807-15.

In various embodiments, the NOVX nucleic acids can be modified at the base moiety, sugar moiety or phosphate backbone to improve, e.g., the stability, hybridization, or solubility of the molecule. For example, the deoxyribose phosphate backbone of the nucleic acids can be modified to generate peptide nucleic acids. See, e.g., Hyrup, *et al.*, 1996. *Bioorg Med Chem* 4: 5-23. As used herein, the terms "peptide nucleic acids" or "PNAs" refer to nucleic acid mimics (e.g., DNA mimics) in which the deoxyribose phosphate backbone is replaced by a pseudopeptide backbone and only the four natural nucleobases are retained. The neutral backbone of PNAs has been shown to allow for specific hybridization to DNA and RNA under conditions of low ionic strength. The synthesis of PNA oligomers can be performed using standard solid phase peptide synthesis protocols as described in Hyrup, *et al.*, 1996. *supra*; Perry-O'Keefe, *et al.*, 1996. *Proc. Natl. Acad. Sci. USA* 93: 14670-14675.

PNAs of NOVX can be used in therapeutic and diagnostic applications. For example, PNAs can be used as antisense or antigene agents for sequence-specific modulation of gene expression by, e.g., inducing transcription or translation arrest or inhibiting replication. PNAs of NOVX can also be used, for example, in the analysis of single base pair mutations in a gene (e.g., PNA directed PCR clamping; as artificial restriction enzymes when used in combination with other enzymes, e.g., S<sub>1</sub> nucleases (See, Hyrup, *et al.*, 1996. *supra*); or as probes or primers for DNA sequence and hybridization (See, Hyrup, *et al.*, 1996, *supra*; Perry-O'Keefe, *et al.*, 1996. *supra*).

In another embodiment, PNAs of NOVX can be modified, e.g., to enhance their stability or cellular uptake, by attaching lipophilic or other helper groups to PNA, by the formation of PNA-DNA chimeras, or by the use of liposomes or other techniques of drug delivery known in the art. For example, PNA-DNA chimeras of NOVX can be generated that

may combine the advantageous properties of PNA and DNA. Such chimeras allow DNA recognition enzymes (e.g., RNase H and DNA polymerases) to interact with the DNA portion while the PNA portion would provide high binding affinity and specificity. PNA-DNA chimeras can be linked using linkers of appropriate lengths selected in terms of base stacking, number of bonds between the nucleobases, and orientation (*see*, Hyrup, *et al.*, 1996. *supra*). The synthesis of PNA-DNA chimeras can be performed as described in Hyrup, *et al.*, 1996. *supra* and Finn, *et al.*, 1996. *Nucl Acids Res* 24: 3357-3363. For example, a DNA chain can be synthesized on a solid support using standard phosphoramidite coupling chemistry, and modified nucleoside analogs, e.g., 5'-(4-methoxytrityl)amino-5'-deoxy-thymidine phosphoramidite, can be used between the PNA and the 5' end of DNA. *See*, e.g., Mag, *et al.*, 1989. *Nucl Acid Res* 17: 5973-5988. PNA monomers are then coupled in a stepwise manner to produce a chimeric molecule with a 5' PNA segment and a 3' DNA segment. *See*, e.g., Finn, *et al.*, 1996. *supra*. Alternatively, chimeric molecules can be synthesized with a 5' DNA segment and a 3' PNA segment. *See*, e.g., Petersen, *et al.*, 1975. *Bioorg. Med. Chem. Lett.* 5: 1119-11124.

In other embodiments, the oligonucleotide may include other appended groups such as peptides (e.g., for targeting host cell receptors *in vivo*), or agents facilitating transport across the cell membrane (*see*, e.g., Letsinger, *et al.*, 1989. *Proc. Natl. Acad. Sci. U.S.A.* 86: 6553-6556; Lemaitre, *et al.*, 1987. *Proc. Natl. Acad. Sci.* 84: 648-652; PCT Publication No. WO88/09810) or the blood-brain barrier (*see*, e.g., PCT Publication No. WO 89/10134). In addition, oligonucleotides can be modified with hybridization triggered cleavage agents (*see*, e.g., Krol, *et al.*, 1988. *BioTechniques* 6:958-976) or intercalating agents (*see*, e.g., Zon, 1988. *Pharm. Res.* 5: 539-549). To this end, the oligonucleotide may be conjugated to another molecule, e.g., a peptide, a hybridization triggered cross-linking agent, a transport agent, a hybridization-triggered cleavage agent, and the like.

### NOVX Polypeptides

A polypeptide according to the invention includes a polypeptide including the amino acid sequence of NOVX polypeptides whose sequences are provided in SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60. The invention also includes a mutant or variant protein any of whose residues may be changed from the corresponding residues shown in SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60 while still encoding a protein that maintains its NOVX activities and physiological functions, or a functional fragment thereof.

In general, an NOVX variant that preserves NOVX-like function includes any variant in which residues at a particular position in the sequence have been substituted by other amino acids, and further include the possibility of inserting an additional residue or residues between two residues of the parent protein as well as the possibility of deleting one or more residues from the parent sequence. Any amino acid substitution, insertion, or deletion is encompassed by the invention. In favorable circumstances, the substitution is a conservative substitution as defined above.

One aspect of the invention pertains to isolated NOVX proteins, and biologically-active portions thereof, or derivatives, fragments, analogs or homologs thereof. Also provided are polypeptide fragments suitable for use as immunogens to raise anti-NOVX antibodies. In one embodiment, native NOVX proteins can be isolated from cells or tissue sources by an appropriate purification scheme using standard protein purification techniques. In another embodiment, NOVX proteins are produced by recombinant DNA techniques. Alternative to recombinant expression, an NOVX protein or polypeptide can be synthesized chemically using standard peptide synthesis techniques.

An "isolated" or "purified" polypeptide or protein or biologically-active portion thereof is substantially free of cellular material or other contaminating proteins from the cell or tissue source from which the NOVX protein is derived, or substantially free from chemical precursors or other chemicals when chemically synthesized. The language "substantially free of cellular material" includes preparations of NOVX proteins in which the protein is separated from cellular components of the cells from which it is isolated or recombinantly-produced. In one embodiment, the language "substantially free of cellular material" includes preparations of NOVX proteins having less than about 30% (by dry weight) of non-NOVX proteins (also referred to herein as a "contaminating protein"), more preferably less than about 20% of non-NOVX proteins, still more preferably less than about 10% of non-NOVX proteins, and most preferably less than about 5% of non-NOVX proteins. When the NOVX protein or biologically-active portion thereof is recombinantly-produced, it is also preferably substantially free of culture medium, *i.e.*, culture medium represents less than about 20%, more preferably less than about 10%, and most preferably less than about 5% of the volume of the NOVX protein preparation.

The language "substantially free of chemical precursors or other chemicals" includes preparations of NOVX proteins in which the protein is separated from chemical precursors or other chemicals that are involved in the synthesis of the protein. In one embodiment, the language "substantially free of chemical precursors or other chemicals" includes preparations



of NOVX proteins having less than about 30% (by dry weight) of chemical precursors or non-NOVX chemicals, more preferably less than about 20% chemical precursors or non-NOVX chemicals, still more preferably less than about 10% chemical precursors or non-NOVX chemicals, and most preferably less than about 5% chemical precursors or non-NOVX chemicals.

Biologically-active portions of NOVX proteins include peptides comprising amino acid sequences sufficiently homologous to or derived from the amino acid sequences of the NOVX proteins (*e.g.*, the amino acid sequence shown in SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60) that include fewer amino acids than the full-length NOVX proteins, and exhibit at least one activity of an NOVX protein. Typically, biologically-active portions comprise a domain or motif with at least one activity of the NOVX protein. A biologically-active portion of an NOVX protein can be a polypeptide which is, for example, 10, 25, 50, 100 or more amino acid residues in length.

Moreover, other biologically-active portions, in which other regions of the protein are deleted, can be prepared by recombinant techniques and evaluated for one or more of the functional activities of a native NOVX protein.

In an embodiment, the NOVX protein has an amino acid sequence shown SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60. In other embodiments, the NOVX protein is substantially homologous to SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60, and retains the functional activity of the protein of SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60, yet differs in amino acid sequence due to natural allelic variation or mutagenesis, as described in detail, below.

Accordingly, in another embodiment, the NOVX protein is a protein that comprises an amino acid sequence at least about 45% homologous to the amino acid sequence SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60, and retains the functional activity of the NOVX proteins of SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60.

### **Determining Homology Between Two or More Sequences**

To determine the percent homology of two amino acid sequences or of two nucleic acids, the sequences are aligned for optimal comparison purposes (*e.g.*, gaps can be introduced

in the sequence of a first amino acid or nucleic acid sequence for optimal alignment with a second amino or nucleic acid sequence). The amino acid residues or nucleotides at corresponding amino acid positions or nucleotide positions are then compared. When a position in the first sequence is occupied by the same amino acid residue or nucleotide as the corresponding position in the second sequence, then the molecules are homologous at that position (*i.e.*, as used herein amino acid or nucleic acid "homology" is equivalent to amino acid or nucleic acid "identity").

The nucleic acid sequence homology may be determined as the degree of identity between two sequences. The homology may be determined using computer programs known in the art, such as GAP software provided in the GCG program package. *See*, Needleman and Wunsch, 1970. *J Mol Biol* 48: 443-453. Using GCG GAP software with the following settings for nucleic acid sequence comparison: GAP creation penalty of 5.0 and GAP extension penalty of 0.3, the coding region of the analogous nucleic acid sequences referred to above exhibits a degree of identity preferably of at least 70%, 75%, 80%, 85%, 90%, 95%, 98%, or 99%, with the CDS (encoding) part of the DNA sequence shown in SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59.

The term "sequence identity" refers to the degree to which two polynucleotide or polypeptide sequences are identical on a residue-by-residue basis over a particular region of comparison. The term "percentage of sequence identity" is calculated by comparing two optimally aligned sequences over that region of comparison, determining the number of positions at which the identical nucleic acid base (*e.g.*, A, T, C, G, U, or I, in the case of nucleic acids) occurs in both sequences to yield the number of matched positions, dividing the number of matched positions by the total number of positions in the region of comparison (*i.e.*, the window size), and multiplying the result by 100 to yield the percentage of sequence identity. The term "substantial identity" as used herein denotes a characteristic of a polynucleotide sequence, wherein the polynucleotide comprises a sequence that has at least 80 percent sequence identity, preferably at least 85 percent identity and often 90 to 95 percent sequence identity, more usually at least 99 percent sequence identity as compared to a reference sequence over a comparison region.

### **Chimeric and Fusion Proteins**

The invention also provides NOVX chimeric or fusion proteins. As used herein, an NOVX "chimeric protein" or "fusion protein" comprises an NOVX polypeptide operatively-linked to a non-NOVX polypeptide. An "NOVX polypeptide" refers to a polypeptide having

an amino acid sequence corresponding to an NOVX protein SEQ ID NOS: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, or 60), whereas a "non-NOVX polypeptide" refers to a polypeptide having an amino acid sequence corresponding to a protein that is not substantially homologous to the NOVX protein, *e.g.*, a protein that is different from the NOVX protein and that is derived from the same or a different organism. Within an NOVX fusion protein the NOVX polypeptide can correspond to all or a portion of an NOVX protein. In one embodiment, an NOVX fusion protein comprises at least one biologically-active portion of an NOVX protein. In another embodiment, an NOVX fusion protein comprises at least two biologically-active portions of an NOVX protein. In yet another embodiment, an NOVX fusion protein comprises at least three biologically-active portions of an NOVX protein. Within the fusion protein, the term "operatively-linked" is intended to indicate that the NOVX polypeptide and the non-NOVX polypeptide are fused in-frame with one another. The non-NOVX polypeptide can be fused to the N-terminus or C-terminus of the NOVX polypeptide.

15 In one embodiment, the fusion protein is a GST-NOVX fusion protein in which the NOVX sequences are fused to the C-terminus of the GST (glutathione S-transferase) sequences. Such fusion proteins can facilitate the purification of recombinant NOVX polypeptides.

20 In another embodiment, the fusion protein is an NOVX protein containing a heterologous signal sequence at its N-terminus. In certain host cells (*e.g.*, mammalian host cells), expression and/or secretion of NOVX can be increased through use of a heterologous signal sequence.

25 In yet another embodiment, the fusion protein is an NOVX-immunoglobulin fusion protein in which the NOVX sequences are fused to sequences derived from a member of the immunoglobulin protein family. The NOVX-immunoglobulin fusion proteins of the invention can be incorporated into pharmaceutical compositions and administered to a subject to inhibit an interaction between an NOVX ligand and an NOVX protein on the surface of a cell, to thereby suppress NOVX-mediated signal transduction *in vivo*. The NOVX-immunoglobulin fusion proteins can be used to affect the bioavailability of an NOVX cognate ligand.

30 Inhibition of the NOVX ligand/NOVX interaction may be useful therapeutically for both the treatment of proliferative and differentiative disorders, as well as modulating (*e.g.* promoting or inhibiting) cell survival. Moreover, the NOVX-immunoglobulin fusion proteins of the invention can be used as immunogens to produce anti-NOVX antibodies in a subject, to purify

NOVX ligands, and in screening assays to identify molecules that inhibit the interaction of NOVX with an NOVX ligand.

An NOVX chimeric or fusion protein of the invention can be produced by standard recombinant DNA techniques. For example, DNA fragments coding for the different polypeptide sequences are ligated together in-frame in accordance with conventional techniques, *e.g.*, by employing blunt-ended or stagger-ended termini for ligation, restriction enzyme digestion to provide for appropriate termini, filling-in of cohesive ends as appropriate, alkaline phosphatase treatment to avoid undesirable joining, and enzymatic ligation. In another embodiment, the fusion gene can be synthesized by conventional techniques including automated DNA synthesizers. Alternatively, PCR amplification of gene fragments can be carried out using anchor primers that give rise to complementary overhangs between two consecutive gene fragments that can subsequently be annealed and reamplified to generate a chimeric gene sequence (*see, e.g.*, Ausubel, *et al.* (eds.) CURRENT PROTOCOLS IN MOLECULAR BIOLOGY, John Wiley & Sons, 1992). Moreover, many expression vectors are commercially available that already encode a fusion moiety (*e.g.*, a GST polypeptide). An NOVX-encoding nucleic acid can be cloned into such an expression vector such that the fusion moiety is linked in-frame to the NOVX protein.

#### **NOVX Agonists and Antagonists**

The invention also pertains to variants of the NOVX proteins that function as either NOVX agonists (*i.e.*, mimetics) or as NOVX antagonists. Variants of the NOVX protein can be generated by mutagenesis (*e.g.*, discrete point mutation or truncation of the NOVX protein). An agonist of the NOVX protein can retain substantially the same, or a subset of, the biological activities of the naturally occurring form of the NOVX protein. An antagonist of the NOVX protein can inhibit one or more of the activities of the naturally occurring form of the NOVX protein by, for example, competitively binding to a downstream or upstream member of a cellular signaling cascade which includes the NOVX protein. Thus, specific biological effects can be elicited by treatment with a variant of limited function. In one embodiment, treatment of a subject with a variant having a subset of the biological activities of the naturally occurring form of the protein has fewer side effects in a subject relative to treatment with the naturally occurring form of the NOVX proteins.

Variants of the NOVX proteins that function as either NOVX agonists (*i.e.*, mimetics) or as NOVX antagonists can be identified by screening combinatorial libraries of mutants (*e.g.*, truncation mutants) of the NOVX proteins for NOVX protein agonist or antagonist activity. In one embodiment, a variegated library of NOVX variants is generated by

combinatorial mutagenesis at the nucleic acid level and is encoded by a variegated gene library. A variegated library of NOVX variants can be produced by, for example, enzymatically ligating a mixture of synthetic oligonucleotides into gene sequences such that a degenerate set of potential NOVX sequences is expressible as individual polypeptides, or alternatively, as a set of larger fusion proteins (*e.g.*, for phage display) containing the set of NOVX sequences therein. There are a variety of methods which can be used to produce libraries of potential NOVX variants from a degenerate oligonucleotide sequence. Chemical synthesis of a degenerate gene sequence can be performed in an automatic DNA synthesizer, and the synthetic gene then ligated into an appropriate expression vector. Use of a degenerate set of genes allows for the provision, in one mixture, of all of the sequences encoding the desired set of potential NOVX sequences. Methods for synthesizing degenerate oligonucleotides are well-known within the art. *See, e.g.*, Narang, 1983. *Tetrahedron* 39: 3; Itakura, *et al.*, 1984. *Annu. Rev. Biochem.* 53: 323; Itakura, *et al.*, 1984. *Science* 198: 1056; Ike, *et al.*, 1983. *Nucl. Acids Res.* 11: 477.

## 15 Polypeptide Libraries

In addition, libraries of fragments of the NOVX protein coding sequences can be used to generate a variegated population of NOVX fragments for screening and subsequent selection of variants of an NOVX protein. In one embodiment, a library of coding sequence fragments can be generated by treating a double stranded PCR fragment of an NOVX coding sequence with a nuclease under conditions wherein nicking occurs only about once per molecule, denaturing the double stranded DNA, renaturing the DNA to form double-stranded DNA that can include sense/antisense pairs from different nicked products, removing single stranded portions from reformed duplexes by treatment with S<sub>1</sub> nuclease, and ligating the resulting fragment library into an expression vector. By this method, expression libraries can be derived which encodes N-terminal and internal fragments of various sizes of the NOVX proteins.

Various techniques are known in the art for screening gene products of combinatorial libraries made by point mutations or truncation, and for screening cDNA libraries for gene products having a selected property. Such techniques are adaptable for rapid screening of the gene libraries generated by the combinatorial mutagenesis of NOVX proteins. The most widely used techniques, which are amenable to high throughput analysis, for screening large gene libraries typically include cloning the gene library into replicable expression vectors, transforming appropriate cells with the resulting library of vectors, and expressing the combinatorial genes under conditions in which detection of a desired activity facilitates

isolation of the vector encoding the gene whose product was detected. Recursive ensemble mutagenesis (REM), a new technique that enhances the frequency of functional mutants in the libraries, can be used in combination with the screening assays to identify NOVX variants. See, e.g., Arkin and Yourvan, 1992. *Proc. Natl. Acad. Sci. USA* 89: 7811-7815; Delgrave, et al., 1993. *Protein Engineering* 6:327-331.

### Anti-NOVX Antibodies

Also included in the invention are antibodies to NOVX proteins, or fragments of NOVX proteins. The term "antibody" as used herein refers to immunoglobulin molecules and immunologically active portions of immunoglobulin (Ig) molecules, i.e., molecules that contain an antigen binding site that specifically binds (immunoreacts with) an antigen. Such antibodies include, but are not limited to, polyclonal, monoclonal, chimeric, single chain, F<sub>ab</sub>, F<sub>ab</sub>' and F<sub>(ab)2</sub> fragments, and an F<sub>ab</sub> expression library. In general, an antibody molecule obtained from humans relates to any of the classes IgG, IgM, IgA, IgE and IgD, which differ from one another by the nature of the heavy chain present in the molecule. Certain classes have subclasses as well, such as IgG<sub>1</sub>, IgG<sub>2</sub>, and others. Furthermore, in humans, the light chain may be a kappa chain or a lambda chain. Reference herein to antibodies includes a reference to all such classes, subclasses and types of human antibody species.

An isolated NOVX-related protein of the invention may be intended to serve as an antigen, or a portion or fragment thereof, and additionally can be used as an immunogen to generate antibodies that immunospecifically bind the antigen, using standard techniques for polyclonal and monoclonal antibody preparation. The full-length protein can be used or, alternatively, the invention provides antigenic peptide fragments of the antigen for use as immunogens. An antigenic peptide fragment comprises at least 6 amino acid residues of the amino acid sequence of the full length protein and encompasses an epitope thereof such that an antibody raised against the peptide forms a specific immune complex with the full length protein or with any fragment that contains the epitope. Preferably, the antigenic peptide comprises at least 10 amino acid residues, or at least 15 amino acid residues, or at least 20 amino acid residues, or at least 30 amino acid residues. Preferred epitopes encompassed by the antigenic peptide are regions of the protein that are located on its surface; commonly these are hydrophilic regions.

In certain embodiments of the invention, at least one epitope encompassed by the antigenic peptide is a region of NOVX-related protein that is located on the surface of the protein, e.g., a hydrophilic region. A hydrophobicity analysis of the human NOVX-related protein sequence will indicate which regions of a NOVX-related protein are particularly

hydrophilic and, therefore, are likely to encode surface residues useful for targeting antibody production. As a means for targeting antibody production, hydropathy plots showing regions of hydrophilicity and hydrophobicity may be generated by any method well known in the art, including, for example, the Kyte Doolittle or the Hopp Woods methods, either with or without Fourier transformation. See, *e.g.*, Hopp and Woods, 1981, *Proc. Nat. Acad. Sci. USA* 78: 3824-3828; Kyte and Doolittle 1982, *J. Mol. Biol.* 157: 105-142, each of which is incorporated herein by reference in its entirety. Antibodies that are specific for one or more domains within an antigenic protein, or derivatives, fragments, analogs or homologs thereof, are also provided herein.

A protein of the invention, or a derivative, fragment, analog, homolog or ortholog thereof, may be utilized as an immunogen in the generation of antibodies that immunospecifically bind these protein components.

Various procedures known within the art may be used for the production of polyclonal or monoclonal antibodies directed against a protein of the invention, or against derivatives, fragments, analogs homologs or orthologs thereof (see, for example, *Antibodies: A Laboratory Manual*, Harlow and Lane, 1988, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY, incorporated herein by reference). Some of these antibodies are discussed below.

#### **Polyclonal Antibodies**

For the production of polyclonal antibodies, various suitable host animals (*e.g.*, rabbit, goat, mouse or other mammal) may be immunized by one or more injections with the native protein, a synthetic variant thereof, or a derivative of the foregoing. An appropriate immunogenic preparation can contain, for example, the naturally occurring immunogenic protein, a chemically synthesized polypeptide representing the immunogenic protein, or a recombinantly expressed immunogenic protein. Furthermore, the protein may be conjugated to a second protein known to be immunogenic in the mammal being immunized. Examples of such immunogenic proteins include but are not limited to keyhole limpet hemocyanin, serum albumin, bovine thyroglobulin, and soybean trypsin inhibitor. The preparation can further include an adjuvant. Various adjuvants used to increase the immunological response include, but are not limited to, Freund's (complete and incomplete), mineral gels (*e.g.*, aluminum hydroxide), surface active substances (*e.g.*, lysolecithin, pluronic polyols, polyanions, peptides, oil emulsions, dinitrophenol, etc.), adjuvants usable in humans such as Bacille Calmette-Guerin and *Corynebacterium parvum*, or similar immunostimulatory agents. Additional examples of adjuvants which can be employed include MPL-TDM adjuvant (monophosphoryl Lipid A, synthetic trehalose dicorynomycolate).

The polyclonal antibody molecules directed against the immunogenic protein can be isolated from the mammal (*e.g.*, from the blood) and further purified by well known techniques, such as affinity chromatography using protein A or protein G, which provide primarily the IgG fraction of immune serum. Subsequently, or alternatively, the specific antigen which is the target of the immunoglobulin sought, or an epitope thereof, may be immobilized on a column to purify the immune specific antibody by immunoaffinity chromatography. Purification of immunoglobulins is discussed, for example, by D. Wilkinson (*The Scientist*, published by The Scientist, Inc., Philadelphia PA, Vol. 14, No. 8 (April 17, 2000), pp. 25-28).

## 10 **Monoclonal Antibodies**

The term "monoclonal antibody" (MAb) or "monoclonal antibody composition", as used herein, refers to a population of antibody molecules that contain only one molecular species of antibody molecule consisting of a unique light chain gene product and a unique heavy chain gene product. In particular, the complementarity determining regions (CDRs) of the monoclonal antibody are identical in all the molecules of the population. MAbs thus contain an antigen binding site capable of immunoreacting with a particular epitope of the antigen characterized by a unique binding affinity for it.

Monoclonal antibodies can be prepared using hybridoma methods, such as those described by Kohler and Milstein, *Nature*, 256:495 (1975). In a hybridoma method, a mouse, hamster, or other appropriate host animal, is typically immunized with an immunizing agent to elicit lymphocytes that produce or are capable of producing antibodies that will specifically bind to the immunizing agent. Alternatively, the lymphocytes can be immunized in vitro.

The immunizing agent will typically include the protein antigen, a fragment thereof or a fusion protein thereof. Generally, either peripheral blood lymphocytes are used if cells of human origin are desired, or spleen cells or lymph node cells are used if non-human mammalian sources are desired. The lymphocytes are then fused with an immortalized cell line using a suitable fusing agent, such as polyethylene glycol, to form a hybridoma cell (Goding, *MONOCLONAL ANTIBODIES: PRINCIPLES AND PRACTICE*, Academic Press, (1986) pp. 59-103). Immortalized cell lines are usually transformed mammalian cells, particularly myeloma cells of rodent, bovine and human origin. Usually, rat or mouse myeloma cell lines are employed. The hybridoma cells can be cultured in a suitable culture medium that preferably contains one or more substances that inhibit the growth or survival of the unfused, immortalized cells. For example, if the parental cells lack the enzyme hypoxanthine guanine phosphoribosyl transferase (HGPRT or HPRT), the culture medium for the hybridomas



typically will include hypoxanthine, aminopterin, and thymidine ("HAT medium"), which substances prevent the growth of HGPRT-deficient cells.

Preferred immortalized cell lines are those that fuse efficiently, support stable high level expression of antibody by the selected antibody-producing cells, and are sensitive to a medium such as HAT medium. More preferred immortalized cell lines are murine myeloma lines, which can be obtained, for instance, from the Salk Institute Cell Distribution Center, San Diego, California and the American Type Culture Collection, Manassas, Virginia. Human myeloma and mouse-human heteromyeloma cell lines also have been described for the production of human monoclonal antibodies (Kozbor, *J. Immunol.*, 133:3001 (1984); Brodeur *et al.*, MONOCLONAL ANTIBODY PRODUCTION TECHNIQUES AND APPLICATIONS, Marcel Dekker, Inc., New York, (1987) pp. 51-63).

The culture medium in which the hybridoma cells are cultured can then be assayed for the presence of monoclonal antibodies directed against the antigen. Preferably, the binding specificity of monoclonal antibodies produced by the hybridoma cells is determined by immunoprecipitation or by an in vitro binding assay, such as radioimmunoassay (RIA) or enzyme-linked immunoabsorbent assay (ELISA). Such techniques and assays are known in the art. The binding affinity of the monoclonal antibody can, for example, be determined by the Scatchard analysis of Munson and Pollard, *Anal. Biochem.*, 107:220 (1980). Preferably, antibodies having a high degree of specificity and a high binding affinity for the target antigen are isolated.

After the desired hybridoma cells are identified, the clones can be subcloned by limiting dilution procedures and grown by standard methods. Suitable culture media for this purpose include, for example, Dulbecco's Modified Eagle's Medium and RPMI-1640 medium. Alternatively, the hybridoma cells can be grown in vivo as ascites in a mammal. The monoclonal antibodies secreted by the subclones can be isolated or purified from the culture medium or ascites fluid by conventional immunoglobulin purification procedures such as, for example, protein A-Sepharose, hydroxylapatite chromatography, gel electrophoresis, dialysis, or affinity chromatography.

The monoclonal antibodies can also be made by recombinant DNA methods, such as those described in U.S. Patent No. 4,816,567. DNA encoding the monoclonal antibodies of the invention can be readily isolated and sequenced using conventional procedures (*e.g.*, by using oligonucleotide probes that are capable of binding specifically to genes encoding the heavy and light chains of murine antibodies). The hybridoma cells of the invention serve as a preferred source of such DNA. Once isolated, the DNA can be placed into expression vectors,

which are then transfected into host cells such as simian COS cells, Chinese hamster ovary (CHO) cells, or myeloma cells that do not otherwise produce immunoglobulin protein, to obtain the synthesis of monoclonal antibodies in the recombinant host cells. The DNA also can be modified, for example, by substituting the coding sequence for human heavy and light chain constant domains in place of the homologous murine sequences (U.S. Patent No. 5 4,816,567; Morrison, *Nature* 368, 812-13 (1994)) or by covalently joining to the immunoglobulin coding sequence all or part of the coding sequence for a non-immunoglobulin polypeptide. Such a non-immunoglobulin polypeptide can be substituted for the constant domains of an antibody of the invention, or can be substituted for the variable domains of one 10 antigen-combining site of an antibody of the invention to create a chimeric bivalent antibody.

### **Humanized Antibodies**

The antibodies directed against the protein antigens of the invention can further comprise humanized antibodies or human antibodies. These antibodies are suitable for administration to humans without engendering an immune response by the human against the administered immunoglobulin. Humanized forms of antibodies are chimeric immunoglobulins, 15 immunoglobulin chains or fragments thereof (such as Fv, Fab, Fab', F(ab')<sub>2</sub> or other antigen-binding subsequences of antibodies) that are principally comprised of the sequence of a human immunoglobulin, and contain minimal sequence derived from a non-human immunoglobulin. Humanization can be performed following the method of Winter and co-workers (Jones *et al.*, *Nature*, 321:522-525 (1986); Riechmann *et al.*, *Nature*, 332:323-327 (1988); Verhoeyen *et al.*, 20 *Science*, 239:1534-1536 (1988)), by substituting rodent CDRs or CDR sequences for the corresponding sequences of a human antibody. (See also U.S. Patent No. 5,225,539.) In some instances, Fv framework residues of the human immunoglobulin are replaced by corresponding non-human residues. Humanized antibodies can also comprise residues which 25 are found neither in the recipient antibody nor in the imported CDR or framework sequences. In general, the humanized antibody will comprise substantially all of at least one, and typically two, variable domains, in which all or substantially all of the CDR regions correspond to those of a non-human immunoglobulin and all or substantially all of the framework regions are those of a human immunoglobulin consensus sequence. The humanized antibody optimally 30 also will comprise at least a portion of an immunoglobulin constant region (Fc), typically that of a human immunoglobulin (Jones *et al.*, 1986; Riechmann *et al.*, 1988; and Presta, *Curr. Op. Struct. Biol.*, 2:593-596 (1992)).

## Human Antibodies

Fully human antibodies relate to antibody molecules in which essentially the entire sequences of both the light chain and the heavy chain, including the CDRs, arise from human genes. Such antibodies are termed “human antibodies”, or “fully human antibodies” herein.

- 5 Human monoclonal antibodies can be prepared by the trioma technique; the human B-cell hybridoma technique (see Kozbor, *et al.*, 1983 *Immunol Today* 4: 72) and the EBV hybridoma technique to produce human monoclonal antibodies (see Cole, *et al.*, 1985 In: MONOCLONAL ANTIBODIES AND CANCER THERAPY, Alan R. Liss, Inc., pp. 77-96). Human monoclonal antibodies may be utilized in the practice of the present invention and may be produced by
- 10 using human hybridomas (see Cote, *et al.*, 1983. *Proc Natl Acad Sci USA* 80: 2026-2030) or by transforming human B-cells with Epstein Barr Virus in vitro (see Cole, *et al.*, 1985 In: MONOCLONAL ANTIBODIES AND CANCER THERAPY, Alan R. Liss, Inc., pp. 77-96).

- In addition, human antibodies can also be produced using additional techniques, including phage display libraries (Hoogenboom and Winter, *J. Mol. Biol.*, 227:381 (1991);
- 15 Marks *et al.*, *J. Mol. Biol.*, 222:581 (1991)). Similarly, human antibodies can be made by introducing human immunoglobulin loci into transgenic animals, *e.g.*, mice in which the endogenous immunoglobulin genes have been partially or completely inactivated. Upon challenge, human antibody production is observed, which closely resembles that seen in humans in all respects, including gene rearrangement, assembly, and antibody repertoire. This
- 20 approach is described, for example, in U.S. Patent Nos. 5,545,807; 5,545,806; 5,569,825; 5,625,126; 5,633,425; 5,661,016, and in Marks *et al.* (*Bio/Technology* 10, 779-783 (1992)); Lonberg *et al.* (*Nature* 368 856-859 (1994)); Morrison (*Nature* 368, 812-13 (1994)); Fishwild *et al.*, (*Nature Biotechnology* 14, 845-51 (1996)); Neuberger (*Nature Biotechnology* 14, 826 (1996)); and Lonberg and Huszar (*Intern. Rev. Immunol.* 13 65-93 (1995)).

- 25 Human antibodies may additionally be produced using transgenic nonhuman animals which are modified so as to produce fully human antibodies rather than the animal's endogenous antibodies in response to challenge by an antigen. (See PCT publication WO94/02602). The endogenous genes encoding the heavy and light immunoglobulin chains in the nonhuman host have been incapacitated, and active loci encoding human heavy and light
- 30 chain immunoglobulins are inserted into the host's genome. The human genes are incorporated, for example, using yeast artificial chromosomes containing the requisite human DNA segments. An animal which provides all the desired modifications is then obtained as progeny by crossbreeding intermediate transgenic animals containing fewer than the full complement of the modifications. The preferred embodiment of such a nonhuman animal is a

mouse, and is termed the Xenomouse<sup>TM</sup> as disclosed in PCT publications WO 96/33735 and WO 96/34096. This animal produces B cells which secrete fully human immunoglobulins. The antibodies can be obtained directly from the animal after immunization with an immunogen of interest, as, for example, a preparation of a polyclonal antibody, or alternatively  
5 from immortalized B cells derived from the animal, such as hybridomas producing monoclonal antibodies. Additionally, the genes encoding the immunoglobulins with human variable regions can be recovered and expressed to obtain the antibodies directly, or can be further modified to obtain analogs of antibodies such as, for example, single chain Fv molecules.

10 An example of a method of producing a nonhuman host, exemplified as a mouse, lacking expression of an endogenous immunoglobulin heavy chain is disclosed in U.S. Patent No. 5,939,598. It can be obtained by a method including deleting the J segment genes from at least one endogenous heavy chain locus in an embryonic stem cell to prevent rearrangement of the locus and to prevent formation of a transcript of a rearranged immunoglobulin heavy chain  
15 locus, the deletion being effected by a targeting vector containing a gene encoding a selectable marker; and producing from the embryonic stem cell a transgenic mouse whose somatic and germ cells contain the gene encoding the selectable marker.

A method for producing an antibody of interest, such as a human antibody, is disclosed in U.S. Patent No. 5,916,771. It includes introducing an expression vector that contains a  
20 nucleotide sequence encoding a heavy chain into one mammalian host cell in culture, introducing an expression vector containing a nucleotide sequence encoding a light chain into another mammalian host cell, and fusing the two cells to form a hybrid cell. The hybrid cell expresses an antibody containing the heavy chain and the light chain.

In a further improvement on this procedure, a method for identifying a clinically  
25 relevant epitope on an immunogen, and a correlative method for selecting an antibody that binds immunospecifically to the relevant epitope with high affinity, are disclosed in PCT publication WO 99/53049.

#### **F<sub>ab</sub> Fragments and Single Chain Antibodies**

According to the invention, techniques can be adapted for the production of  
30 single-chain antibodies specific to an antigenic protein of the invention (see *e.g.*, U.S. Patent No. 4,946,778). In addition, methods can be adapted for the construction of F<sub>ab</sub> expression libraries (see *e.g.*, Huse, *et al.*, 1989 Science 246: 1275-1281) to allow rapid and effective identification of monoclonal F<sub>ab</sub> fragments with the desired specificity for a protein or derivatives, fragments, analogs or homologs thereof. Antibody fragments that contain the

idiotypes to a protein antigen may be produced by techniques known in the art including, but not limited to: (i) an  $F_{(ab)_2}$  fragment produced by pepsin digestion of an antibody molecule; (ii) an  $F_{ab}$  fragment generated by reducing the disulfide bridges of an  $F_{(ab)_2}$  fragment; (iii) an  $F_{ab}$  fragment generated by the treatment of the antibody molecule with papain and a reducing agent and (iv)  $F_v$  fragments.

### **Bispecific Antibodies**

Bispecific antibodies are monoclonal, preferably human or humanized, antibodies that have binding specificities for at least two different antigens. In the present case, one of the binding specificities is for an antigenic protein of the invention. The second binding target is any other antigen, and advantageously is a cell-surface protein or receptor or receptor subunit. Methods for making bispecific antibodies are known in the art. Traditionally, the recombinant production of bispecific antibodies is based on the co-expression of two immunoglobulin heavy-chain/light-chain pairs, where the two heavy chains have different specificities (Milstein and Cuello, *Nature*, 305:537-539 (1983)). Because of the random assortment of immunoglobulin heavy and light chains, these hybridomas (quadromas) produce a potential mixture of ten different antibody molecules, of which only one has the correct bispecific structure. The purification of the correct molecule is usually accomplished by affinity chromatography steps. Similar procedures are disclosed in WO 93/08829, published 13 May 1993, and in Traunecker *et al.*, 1991 *EMBO J.*, 10:3655-3659.

Antibody variable domains with the desired binding specificities (antibody-antigen combining sites) can be fused to immunoglobulin constant domain sequences. The fusion preferably is with an immunoglobulin heavy-chain constant domain, comprising at least part of the hinge, CH2, and CH3 regions. It is preferred to have the first heavy-chain constant region (CH1) containing the site necessary for light-chain binding present in at least one of the fusions. DNAs encoding the immunoglobulin heavy-chain fusions and, if desired, the immunoglobulin light chain, are inserted into separate expression vectors, and are co-transfected into a suitable host organism. For further details of generating bispecific antibodies see, for example, Suresh *et al.*, *Methods in Enzymology*, 121:210 (1986).

According to another approach described in WO 96/27011, the interface between a pair of antibody molecules can be engineered to maximize the percentage of heterodimers which are recovered from recombinant cell culture. The preferred interface comprises at least a part of the CH3 region of an antibody constant domain. In this method, one or more small amino acid side chains from the interface of the first antibody molecule are replaced with larger side chains (*e.g.* tyrosine or tryptophan). Compensatory "cavities" of identical or similar size to the

large side chain(s) are created on the interface of the second antibody molecule by replacing large amino acid side chains with smaller ones (e.g. alanine or threonine). This provides a mechanism for increasing the yield of the heterodimer over other unwanted end-products such as homodimers.

5           Bispecific antibodies can be prepared as full length antibodies or antibody fragments (e.g.  $F(ab')_2$  bispecific antibodies). Techniques for generating bispecific antibodies from antibody fragments have been described in the literature. For example, bispecific antibodies can be prepared using chemical linkage. Brennan *et al.*, *Science* 229:81 (1985) describe a procedure wherein intact antibodies are proteolytically cleaved to generate  $F(ab')_2$  fragments.  
10   These fragments are reduced in the presence of the dithiol complexing agent sodium arsenite to stabilize vicinal dithiols and prevent intermolecular disulfide formation. The  $Fab'$  fragments generated are then converted to thionitrobenzoate (TNB) derivatives. One of the  $Fab'$ -TNB derivatives is then reconverted to the  $Fab'$ -thiol by reduction with mercaptoethylamine and is mixed with an equimolar amount of the other  $Fab'$ -TNB derivative  
15   to form the bispecific antibody. The bispecific antibodies produced can be used as agents for the selective immobilization of enzymes.

          Additionally,  $Fab'$  fragments can be directly recovered from *E. coli* and chemically coupled to form bispecific antibodies. Shalaby *et al.*, *J. Exp. Med.* 175:217-225 (1992) describe the production of a fully humanized bispecific antibody  $F(ab')_2$  molecule. Each  $Fab'$   
20   fragment was separately secreted from *E. coli* and subjected to directed chemical coupling in vitro to form the bispecific antibody. The bispecific antibody thus formed was able to bind to cells overexpressing the ErbB2 receptor and normal human T cells, as well as trigger the lytic activity of human cytotoxic lymphocytes against human breast tumor targets.

          Various techniques for making and isolating bispecific antibody fragments directly  
25   from recombinant cell culture have also been described. For example, bispecific antibodies have been produced using leucine zippers. Kostelny *et al.*, *J. Immunol.* 148(5):1547-1553 (1992). The leucine zipper peptides from the Fos and Jun proteins were linked to the  $Fab'$  portions of two different antibodies by gene fusion. The antibody homodimers were reduced at the hinge region to form monomers and then re-oxidized to form the antibody heterodimers.  
30   This method can also be utilized for the production of antibody homodimers. The "diabody" technology described by Hollinger *et al.*, *Proc. Natl. Acad. Sci. USA* 90:6444-6448 (1993) has provided an alternative mechanism for making bispecific antibody fragments. The fragments comprise a heavy-chain variable domain ( $V_H$ ) connected to a light-chain variable domain ( $V_L$ ) by a linker which is too short to allow pairing between the two domains on the same chain.

Accordingly, the V<sub>H</sub> and V<sub>L</sub> domains of one fragment are forced to pair with the complementary V<sub>L</sub> and V<sub>H</sub> domains of another fragment, thereby forming two antigen-binding sites. Another strategy for making bispecific antibody fragments by the use of single-chain Fv (sFv) dimers has also been reported. See, Gruber *et al.*, *J. Immunol.* 152:5368 (1994).

- 5 Antibodies with more than two valencies are contemplated. For example, trispecific antibodies can be prepared. Tutt *et al.*, *J. Immunol.* 147:60 (1991).

Exemplary bispecific antibodies can bind to two different epitopes, at least one of which originates in the protein antigen of the invention. Alternatively, an anti-antigenic arm of an immunoglobulin molecule can be combined with an arm which binds to a triggering  
10 molecule on a leukocyte such as a T-cell receptor molecule (*e.g.* CD2, CD3, CD28, or B7), or Fc receptors for IgG (FcγR), such as FcγRI (CD64), FcγRII (CD32) and FcγRIII (CD16) so as to focus cellular defense mechanisms to the cell expressing the particular antigen. Bispecific antibodies can also be used to direct cytotoxic agents to cells which express a particular antigen. These antibodies possess an antigen-binding arm and an arm which binds a cytotoxic  
15 agent or a radionuclide chelator, such as EOTUBE, DPTA, DOTA, or TETA. Another bispecific antibody of interest binds the protein antigen described herein and further binds tissue factor (TF).

#### **Heteroconjugate Antibodies**

- Heteroconjugate antibodies are also within the scope of the present invention.
- 20 Heteroconjugate antibodies are composed of two covalently joined antibodies. Such antibodies have, for example, been proposed to target immune system cells to unwanted cells (U.S. Patent No. 4,676,980), and for treatment of HIV infection (WO 91/00360; WO 92/200373; EP 03089). It is contemplated that the antibodies can be prepared in vitro using known methods in synthetic protein chemistry, including those involving crosslinking agents.
- 25 For example, immunotoxins can be constructed using a disulfide exchange reaction or by forming a thioether bond. Examples of suitable reagents for this purpose include iminothiolate and methyl-4-mercaptobutyrimidate and those disclosed, for example, in U.S. Patent No. 4,676,980.

#### **Effector Function Engineering**

- 30 It can be desirable to modify the antibody of the invention with respect to effector function, so as to enhance, *e.g.*, the effectiveness of the antibody in treating cancer. For example, cysteine residue(s) can be introduced into the Fc region, thereby allowing interchain disulfide bond formation in this region. The homodimeric antibody thus generated can have improved internalization capability and/or increased complement-mediated cell killing and

antibody-dependent cellular cytotoxicity (ADCC). See Caron *et al.*, J. Exp Med., 176: 1191-1195 (1992) and Shopes, J. Immunol., 148: 2918-2922 (1992). Homodimeric antibodies with enhanced anti-tumor activity can also be prepared using heterobifunctional cross-linkers as described in Wolff *et al.* Cancer Research, 53: 2560-2565 (1993). Alternatively, an antibody  
5 can be engineered that has dual Fc regions and can thereby have enhanced complement lysis and ADCC capabilities. See Stevenson *et al.*, Anti-Cancer Drug Design, 3: 219-230 (1989).

### Immunoconjugates

The invention also pertains to immunoconjugates comprising an antibody conjugated to a cytotoxic agent such as a chemotherapeutic agent, toxin (*e.g.*, an enzymatically active  
10 toxin of bacterial, fungal, plant, or animal origin, or fragments thereof), or a radioactive isotope (*i.e.*, a radioconjugate).

Chemotherapeutic agents useful in the generation of such immunoconjugates have been described above. Enzymatically active toxins and fragments thereof that can be used include diphtheria A chain, nonbinding active fragments of diphtheria toxin, exotoxin A chain  
15 (from *Pseudomonas aeruginosa*), ricin A chain, abrin A chain, modeccin A chain, alpha-sarcin, Aleurites fordii proteins, dianthin proteins, *Phytolacca americana* proteins (PAPI, PAPII, and PAP-S), momordica charantia inhibitor, curcin, crotin, sapaonaria officinalis inhibitor, gelonin, mitogellin, restrictocin, phenomycin, enomycin, and the tricothecenes. A variety of radionuclides are available for the production of radioconjugated antibodies. Examples  
20 include  $^{212}\text{Bi}$ ,  $^{131}\text{I}$ ,  $^{131}\text{In}$ ,  $^{90}\text{Y}$ , and  $^{186}\text{Re}$ .

Conjugates of the antibody and cytotoxic agent are made using a variety of bifunctional protein-coupling agents such as N-succinimidyl-3-(2-pyridyldithiol) propionate (SPDP), iminothiolane (IT), bifunctional derivatives of imidoesters (such as dimethyl adipimidate HCL), active esters (such as disuccinimidyl suberate), aldehydes (such as  
25 glutaraldehyde), bis-azido compounds (such as bis (p-azidobenzoyl) hexanediamine), bis-diazonium derivatives (such as bis-(p-diazoniumbenzoyl)-ethylenediamine), diisocyanates (such as tolyene 2,6-diisocyanate), and bis-active fluorine compounds (such as 1,5-difluoro-2,4-dinitrobenzene). For example, a ricin immunotoxin can be prepared as described in Vitetta *et al.*, Science, 238: 1098 (1987). Carbon-14-labeled 1-isothiocyanatobenzyl-3-  
30 methyl-diethylene triaminepentaacetic acid (MX-DTPA) is an exemplary chelating agent for conjugation of radionucleotide to the antibody. See WO94/11026.

In another embodiment, the antibody can be conjugated to a "receptor" (such as streptavidin) for utilization in tumor pretargeting wherein the antibody-receptor conjugate is administered to the patient, followed by removal of unbound conjugate from the circulation



using a clearing agent and then administration of a "ligand" (*e.g.*, avidin) that is in turn conjugated to a cytotoxic agent.

In one embodiment, methods for the screening of antibodies that possess the desired specificity include, but are not limited to, enzyme-linked immunosorbent assay (ELISA) and other immunologically-mediated techniques known within the art. In a specific embodiment, selection of antibodies that are specific to a particular domain of an NOVX protein is facilitated by generation of hybridomas that bind to the fragment of an NOVX protein possessing such a domain. Thus, antibodies that are specific for a desired domain within an NOVX protein, or derivatives, fragments, analogs or homologs thereof, are also provided herein.

Anti-NOVX antibodies may be used in methods known within the art relating to the localization and/or quantitation of an NOVX protein (*e.g.*, for use in measuring levels of the NOVX protein within appropriate physiological samples, for use in diagnostic methods, for use in imaging the protein, and the like). In a given embodiment, antibodies for NOVX proteins, or derivatives, fragments, analogs or homologs thereof, that contain the antibody derived binding domain, are utilized as pharmacologically-active compounds (hereinafter "Therapeutics").

An anti-NOVX antibody (*e.g.*, monoclonal antibody) can be used to isolate an NOVX polypeptide by standard techniques, such as affinity chromatography or immunoprecipitation. An anti-NOVX antibody can facilitate the purification of natural NOVX polypeptide from cells and of recombinantly-produced NOVX polypeptide expressed in host cells. Moreover, an anti-NOVX antibody can be used to detect NOVX protein (*e.g.*, in a cellular lysate or cell supernatant) in order to evaluate the abundance and pattern of expression of the NOVX protein. Anti-NOVX antibodies can be used diagnostically to monitor protein levels in tissue as part of a clinical testing procedure, *e.g.*, to, for example, determine the efficacy of a given treatment regimen. Detection can be facilitated by coupling (*i.e.*, physically linking) the antibody to a detectable substance. Examples of detectable substances include various enzymes, prosthetic groups, fluorescent materials, luminescent materials, bioluminescent materials, and radioactive materials. Examples of suitable enzymes include horseradish peroxidase, alkaline phosphatase,  $\beta$ -galactosidase, or acetylcholinesterase; examples of suitable prosthetic group complexes include streptavidin/biotin and avidin/biotin; examples of suitable fluorescent materials include umbelliferone, fluorescein, fluorescein isothiocyanate, rhodamine, dichlorotriazinylamine fluorescein, dansyl chloride or phycoerythrin; an example of a luminescent material includes luminol; examples of bioluminescent materials include

luciferase, luciferin, and aequorin, and examples of suitable radioactive material include  $^{125}\text{I}$ ,  $^{131}\text{I}$ ,  $^{35}\text{S}$  or  $^3\text{H}$ .

### NOVX Recombinant Expression Vectors and Host Cells

Another aspect of the invention pertains to vectors, preferably expression vectors,  
5 containing a nucleic acid encoding an NOVX protein, or derivatives, fragments, analogs or  
homologs thereof. As used herein, the term "vector" refers to a nucleic acid molecule capable  
of transporting another nucleic acid to which it has been linked. One type of vector is a  
"plasmid", which refers to a circular double stranded DNA loop into which additional DNA  
10 segments can be ligated. Another type of vector is a viral vector, wherein additional DNA  
segments can be ligated into the viral genome. Certain vectors are capable of autonomous  
replication in a host cell into which they are introduced (*e.g.*, bacterial vectors having a  
bacterial origin of replication and episomal mammalian vectors). Other vectors (*e.g.*,  
non-episomal mammalian vectors) are integrated into the genome of a host cell upon  
15 introduction into the host cell, and thereby are replicated along with the host genome.  
Moreover, certain vectors are capable of directing the expression of genes to which they are  
operatively-linked. Such vectors are referred to herein as "expression vectors". In general,  
expression vectors of utility in recombinant DNA techniques are often in the form of plasmids.  
In the present specification, "plasmid" and "vector" can be used interchangeably as the  
20 plasmid is the most commonly used form of vector. However, the invention is intended to  
include such other forms of expression vectors, such as viral vectors (*e.g.*, replication defective  
retroviruses, adenoviruses and adeno-associated viruses), which serve equivalent functions.

The recombinant expression vectors of the invention comprise a nucleic acid of the  
invention in a form suitable for expression of the nucleic acid in a host cell, which means that  
the recombinant expression vectors include one or more regulatory sequences, selected on the  
25 basis of the host cells to be used for expression, that is operatively-linked to the nucleic acid  
sequence to be expressed. Within a recombinant expression vector, "operably-linked" is  
intended to mean that the nucleotide sequence of interest is linked to the regulatory  
sequence(s) in a manner that allows for expression of the nucleotide sequence (*e.g.*, in an *in*  
*vitro* transcription/translation system or in a host cell when the vector is introduced into the  
30 host cell).

The term "regulatory sequence" is intended to include promoters, enhancers and other  
expression control elements (*e.g.*, polyadenylation signals). Such regulatory sequences are  
described, for example, in Goeddel, GENE EXPRESSION TECHNOLOGY: METHODS IN  
ENZYMOLGY 185, Academic Press, San Diego, Calif. (1990). Regulatory sequences include

those that direct constitutive expression of a nucleotide sequence in many types of host cell and those that direct expression of the nucleotide sequence only in certain host cells (*e.g.*, tissue-specific regulatory sequences). It will be appreciated by those skilled in the art that the design of the expression vector can depend on such factors as the choice of the host cell to be transformed, the level of expression of protein desired, etc. The expression vectors of the invention can be introduced into host cells to thereby produce proteins or peptides, including fusion proteins or peptides, encoded by nucleic acids as described herein (*e.g.*, NOVX proteins, mutant forms of NOVX proteins, fusion proteins, etc.).

The recombinant expression vectors of the invention can be designed for expression of NOVX proteins in prokaryotic or eukaryotic cells. For example, NOVX proteins can be expressed in bacterial cells such as *Escherichia coli*, insect cells (using baculovirus expression vectors) yeast cells or mammalian cells. Suitable host cells are discussed further in Goeddel, GENE EXPRESSION TECHNOLOGY: METHODS IN ENZYMOLOGY 185, Academic Press, San Diego, Calif. (1990). Alternatively, the recombinant expression vector can be transcribed and translated *in vitro*, for example using T7 promoter regulatory sequences and T7 polymerase. Expression of proteins in prokaryotes is most often carried out in *Escherichia coli* with vectors containing constitutive or inducible promoters directing the expression of either fusion or non-fusion proteins. Fusion vectors add a number of amino acids to a protein encoded therein, usually to the amino terminus of the recombinant protein. Such fusion vectors typically serve three purposes: (i) to increase expression of recombinant protein; (ii) to increase the solubility of the recombinant protein; and (iii) to aid in the purification of the recombinant protein by acting as a ligand in affinity purification. Often, in fusion expression vectors, a proteolytic cleavage site is introduced at the junction of the fusion moiety and the recombinant protein to enable separation of the recombinant protein from the fusion moiety subsequent to purification of the fusion protein. Such enzymes, and their cognate recognition sequences, include Factor Xa, thrombin and enterokinase. Typical fusion expression vectors include pGEX (Pharmacia Biotech Inc; Smith and Johnson, 1988. *Gene* 67: 31-40), pMAL (New England Biolabs, Beverly, Mass.) and pRIT5 (Pharmacia, Piscataway, N.J.) that fuse glutathione S-transferase (GST), maltose E binding protein, or protein A, respectively, to the target recombinant protein. Examples of suitable inducible non-fusion *E. coli* expression vectors include pTrc (Amrann *et al.*, (1988) *Gene* 69:301-315) and pET 11d (Studier *et al.*, GENE EXPRESSION TECHNOLOGY: METHODS IN ENZYMOLOGY 185, Academic Press, San Diego, Calif. (1990) 60-89).

One strategy to maximize recombinant protein expression in *E. coli* is to express the protein in a host bacteria with an impaired capacity to proteolytically cleave the recombinant

protein. See, e.g., Gottesman, GENE EXPRESSION TECHNOLOGY: METHODS IN ENZYMOLOGY 185, Academic Press, San Diego, Calif. (1990) 119-128. Another strategy is to alter the nucleic acid sequence of the nucleic acid to be inserted into an expression vector so that the individual codons for each amino acid are those preferentially utilized in *E. coli* (see, e.g.,  
5 Wada, *et al.*, 1992. *Nucl. Acids Res.* 20: 2111-2118). Such alteration of nucleic acid sequences of the invention can be carried out by standard DNA synthesis techniques. In another embodiment, the NOVX expression vector is a yeast expression vector. Examples of vectors for expression in yeast *Saccharomyces cerevisiae* include pYepSec1 (Baldari, *et al.*, 1987. *EMBO J.* 6: 229-234), pMFa (Kurjan and Herskowitz, 1982. *Cell* 30: 933-943), pJRY88  
10 (Schultz *et al.*, 1987. *Gene* 54: 113-123), pYES2 (Invitrogen Corporation, San Diego, Calif.), and picZ (Invitrogen Corp, San Diego, Calif.).

Alternatively, NOVX can be expressed in insect cells using baculovirus expression vectors. Baculovirus vectors available for expression of proteins in cultured insect cells (e.g., SF9 cells) include the pAc series (Smith, *et al.*, 1983. *Mol. Cell. Biol.* 3: 2156-2165) and the  
15 pVL series (Lucklow and Summers, 1989. *Virology* 170: 31-39).

In yet another embodiment, a nucleic acid of the invention is expressed in mammalian cells using a mammalian expression vector. Examples of mammalian expression vectors include pCDM8 (Seed, 1987. *Nature* 329: 840) and pMT2PC (Kaufman, *et al.*, 1987. *EMBO J.* 6: 187-195). When used in mammalian cells, the expression vector's control functions are  
20 often provided by viral regulatory elements. For example, commonly used promoters are derived from polyoma, adenovirus 2, cytomegalovirus, and simian virus 40. For other suitable expression systems for both prokaryotic and eukaryotic cells see, e.g., Chapters 16 and 17 of Sambrook, *et al.*, MOLECULAR CLONING: A LABORATORY MANUAL. 2nd ed., Cold Spring Harbor Laboratory, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y., 1989.  
25 In another embodiment, the recombinant mammalian expression vector is capable of directing expression of the nucleic acid preferentially in a particular cell type (e.g., tissue-specific regulatory elements are used to express the nucleic acid). Tissue-specific regulatory elements are known in the art. Non-limiting examples of suitable tissue-specific promoters include the albumin promoter (liver-specific; Pinkert, *et al.*, 1987. *Genes Dev.* 1: 268-277),  
30 lymphoid-specific promoters (Calame and Eaton, 1988. *Adv. Immunol.* 43: 235-275), in particular promoters of T cell receptors (Winoto and Baltimore, 1989. *EMBO J.* 8: 729-733) and immunoglobulins (Banerji, *et al.*, 1983. *Cell* 33: 729-740; Queen and Baltimore, 1983. *Cell* 33: 741-748), neuron-specific promoters (e.g., the neurofilament promoter; Byrne and Ruddle, 1989. *Proc. Natl. Acad. Sci. USA* 86: 5473-5477), pancreas-specific promoters

(Edlund, *et al.*, 1985. *Science* 230: 912-916), and mammary gland-specific promoters (*e.g.*, milk whey promoter; U.S. Pat. No. 4,873,316 and European Application Publication No. 264,166). Developmentally-regulated promoters are also encompassed, *e.g.*, the murine hox promoters (Kessel and Gruss, 1990. *Science* 249: 374-379) and the  $\alpha$ -fetoprotein promoter  
5 (Campes and Tilghman, 1989. *Genes Dev.* 3: 537-546).

The invention further provides a recombinant expression vector comprising a DNA molecule of the invention cloned into the expression vector in an antisense orientation. That is, the DNA molecule is operatively-linked to a regulatory sequence in a manner that allows for expression (by transcription of the DNA molecule) of an RNA molecule that is antisense to  
10 NOVX mRNA. Regulatory sequences operatively linked to a nucleic acid cloned in the antisense orientation can be chosen that direct the continuous expression of the antisense RNA molecule in a variety of cell types, for instance viral promoters and/or enhancers, or regulatory sequences can be chosen that direct constitutive, tissue specific or cell type specific expression of antisense RNA. The antisense expression vector can be in the form of a recombinant  
15 plasmid, phagemid or attenuated virus in which antisense nucleic acids are produced under the control of a high efficiency regulatory region, the activity of which can be determined by the cell type into which the vector is introduced. For a discussion of the regulation of gene expression using antisense genes *see, e.g.*, Weintraub, *et al.*, "Antisense RNA as a molecular tool for genetic analysis," *Reviews-Trends in Genetics*, Vol. 1(1) 1986.

Another aspect of the invention pertains to host cells into which a recombinant expression vector of the invention has been introduced. The terms "host cell" and "recombinant host cell" are used interchangeably herein. It is understood that such terms refer not only to the particular subject cell but also to the progeny or potential progeny of such a cell. Because certain modifications may occur in succeeding generations due to either  
20 mutation or environmental influences, such progeny may not, in fact, be identical to the parent cell, but are still included within the scope of the term as used herein.

A host cell can be any prokaryotic or eukaryotic cell. For example, NOVX protein can be expressed in bacterial cells such as *E. coli*, insect cells, yeast or mammalian cells (such as Chinese hamster ovary cells (CHO) or COS cells). Other suitable host cells are known to  
25 those skilled in the art.

Vector DNA can be introduced into prokaryotic or eukaryotic cells via conventional transformation or transfection techniques. As used herein, the terms "transformation" and "transfection" are intended to refer to a variety of art-recognized techniques for introducing foreign nucleic acid (*e.g.*, DNA) into a host cell, including calcium phosphate or calcium  
30

chloride co-precipitation, DEAE-dextran-mediated transfection, lipofection, or electroporation. Suitable methods for transforming or transfecting host cells can be found in Sambrook, *et al.* (MOLECULAR CLONING: A LABORATORY MANUAL. 2nd ed., Cold Spring Harbor Laboratory, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y., 1989), and other laboratory manuals.

For stable transfection of mammalian cells, it is known that, depending upon the expression vector and transfection technique used, only a small fraction of cells may integrate the foreign DNA into their genome. In order to identify and select these integrants, a gene that encodes a selectable marker (*e.g.*, resistance to antibiotics) is generally introduced into the host cells along with the gene of interest. Various selectable markers include those that confer resistance to drugs, such as G418, hygromycin and methotrexate. Nucleic acid encoding a selectable marker can be introduced into a host cell on the same vector as that encoding NOVX or can be introduced on a separate vector. Cells stably transfected with the introduced nucleic acid can be identified by drug selection (*e.g.*, cells that have incorporated the selectable marker gene will survive, while the other cells die).

A host cell of the invention, such as a prokaryotic or eukaryotic host cell in culture, can be used to produce (*i.e.*, express) NOVX protein. Accordingly, the invention further provides methods for producing NOVX protein using the host cells of the invention. In one embodiment, the method comprises culturing the host cell of invention (into which a recombinant expression vector encoding NOVX protein has been introduced) in a suitable medium such that NOVX protein is produced. In another embodiment, the method further comprises isolating NOVX protein from the medium or the host cell.

### **Transgenic NOVX Animals**

The host cells of the invention can also be used to produce non-human transgenic animals. For example, in one embodiment, a host cell of the invention is a fertilized oocyte or an embryonic stem cell into which NOVX protein-coding sequences have been introduced. Such host cells can then be used to create non-human transgenic animals in which exogenous NOVX sequences have been introduced into their genome or homologous recombinant animals in which endogenous NOVX sequences have been altered. Such animals are useful for studying the function and/or activity of NOVX protein and for identifying and/or evaluating modulators of NOVX protein activity. As used herein, a "transgenic animal" is a non-human animal, preferably a mammal, more preferably a rodent such as a rat or mouse, in which one or more of the cells of the animal includes a transgene. Other examples of transgenic animals include non-human primates, sheep, dogs, cows, goats, chickens,

amphibians, etc. A transgene is exogenous DNA that is integrated into the genome of a cell from which a transgenic animal develops and that remains in the genome of the mature animal, thereby directing the expression of an encoded gene product in one or more cell types or tissues of the transgenic animal. As used herein, a "homologous recombinant animal" is a non-human animal, preferably a mammal, more preferably a mouse, in which an endogenous NOVX gene has been altered by homologous recombination between the endogenous gene and an exogenous DNA molecule introduced into a cell of the animal, e.g., an embryonic cell of the animal, prior to development of the animal.

A transgenic animal of the invention can be created by introducing NOVX-encoding nucleic acid into the male pronuclei of a fertilized oocyte (e.g., by microinjection, retroviral infection) and allowing the oocyte to develop in a pseudopregnant female foster animal. The human NOVX cDNA sequences SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59 can be introduced as a transgene into the genome of a non-human animal. Alternatively, a non-human homologue of the human NOVX gene, such as a mouse NOVX gene, can be isolated based on hybridization to the human NOVX cDNA (described further *supra*) and used as a transgene. Intronic sequences and polyadenylation signals can also be included in the transgene to increase the efficiency of expression of the transgene. A tissue-specific regulatory sequence(s) can be operably-linked to the NOVX transgene to direct expression of NOVX protein to particular cells. Methods for generating transgenic animals via embryo manipulation and microinjection, particularly animals such as mice, have become conventional in the art and are described, for example, in U.S. Patent Nos. 4,736,866; 4,870,009; and 4,873,191; and Hogan, 1986. In: MANIPULATING THE MOUSE EMBRYO, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y. Similar methods are used for production of other transgenic animals. A transgenic founder animal can be identified based upon the presence of the NOVX transgene in its genome and/or expression of NOVX mRNA in tissues or cells of the animals. A transgenic founder animal can then be used to breed additional animals carrying the transgene. Moreover, transgenic animals carrying a transgene-encoding NOVX protein can further be bred to other transgenic animals carrying other transgenes.

To create a homologous recombinant animal, a vector is prepared which contains at least a portion of an NOVX gene into which a deletion, addition or substitution has been introduced to thereby alter, e.g., functionally disrupt, the NOVX gene. The NOVX gene can be a human gene (e.g., the cDNA of SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59), but more preferably, is a

non-human homologue of a human NOVX gene. For example, a mouse homologue of human NOVX gene of SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59 can be used to construct a homologous recombination vector suitable for altering an endogenous NOVX gene in the mouse genome.

- 5 In one embodiment, the vector is designed such that, upon homologous recombination, the endogenous NOVX gene is functionally disrupted (*i.e.*, no longer encodes a functional protein; also referred to as a "knock out" vector).

- Alternatively, the vector can be designed such that, upon homologous recombination, the endogenous NOVX gene is mutated or otherwise altered but still encodes functional protein (*e.g.*, the upstream regulatory region can be altered to thereby alter the expression of the endogenous NOVX protein). In the homologous recombination vector, the altered portion of the NOVX gene is flanked at its 5'- and 3'-termini by additional nucleic acid of the NOVX gene to allow for homologous recombination to occur between the exogenous NOVX gene carried by the vector and an endogenous NOVX gene in an embryonic stem cell. The additional flanking NOVX nucleic acid is of sufficient length for successful homologous recombination with the endogenous gene. Typically, several kilobases of flanking DNA (both at the 5'- and 3'-termini) are included in the vector. *See, e.g., Thomas, et al., 1987. Cell 51: 503* for a description of homologous recombination vectors. The vector is then introduced into an embryonic stem cell line (*e.g.*, by electroporation) and cells in which the introduced NOVX gene has homologously-recombined with the endogenous NOVX gene are selected. *See, e.g., Li, et al., 1992. Cell 69: 915.*

- The selected cells are then injected into a blastocyst of an animal (*e.g.*, a mouse) to form aggregation chimeras. *See, e.g., Bradley, 1987. In: TERATOCARCINOMAS AND EMBRYONIC STEM CELLS: A PRACTICAL APPROACH, Robertson, ed. IRL, Oxford, pp. 113-152.*
- 25 A chimeric embryo can then be implanted into a suitable pseudopregnant female foster animal and the embryo brought to term. Progeny harboring the homologously-recombined DNA in their germ cells can be used to breed animals in which all cells of the animal contain the homologously-recombined DNA by germline transmission of the transgene. Methods for constructing homologous recombination vectors and homologous recombinant animals are described further in Bradley, 1991. *Curr. Opin. Biotechnol. 2: 823-829*; PCT International Publication Nos.: WO 90/11354; WO 91/01140; WO 92/0968; and WO 93/04169.

In another embodiment, transgenic non-humans animals can be produced that contain selected systems that allow for regulated expression of the transgene. One example of such a system is the cre/loxP recombinase system of bacteriophage P1. For a description of the



cre/loxP recombinase system, *See, e.g., Lakso, et al., 1992. Proc. Natl. Acad. Sci. USA* 89: 6232-6236. Another example of a recombinase system is the FLP recombinase system of *Saccharomyces cerevisiae*. *See, O'Gorman, et al., 1991. Science* 251:1351-1355. If a cre/loxP recombinase system is used to regulate expression of the transgene, animals containing  
5 transgenes encoding both the Cre recombinase and a selected protein are required. Such animals can be provided through the construction of "double" transgenic animals, *e.g.,* by mating two transgenic animals, one containing a transgene encoding a selected protein and the other containing a transgene encoding a recombinase.

Clones of the non-human transgenic animals described herein can also be produced  
10 according to the methods described in Wilmut, *et al., 1997. Nature* 385: 810-813. In brief, a cell (*e.g.,* a somatic cell) from the transgenic animal can be isolated and induced to exit the growth cycle and enter G<sub>0</sub> phase. The quiescent cell can then be fused, *e.g.,* through the use of electrical pulses, to an enucleated oocyte from an animal of the same species from which the quiescent cell is isolated. The reconstructed oocyte is then cultured such that it develops to  
15 morula or blastocyte and then transferred to pseudopregnant female foster animal. The offspring borne of this female foster animal will be a clone of the animal from which the cell (*e.g.,* the somatic cell) is isolated.

### Pharmaceutical Compositions

The NOVX nucleic acid molecules, NOVX proteins, and anti-NOVX antibodies (also  
20 referred to herein as "active compounds") of the invention, and derivatives, fragments, analogs and homologs thereof, can be incorporated into pharmaceutical compositions suitable for administration. Such compositions typically comprise the nucleic acid molecule, protein, or antibody and a pharmaceutically acceptable carrier. As used herein, "pharmaceutically acceptable carrier" is intended to include any and all solvents, dispersion media, coatings,  
25 antibacterial and antifungal agents, isotonic and absorption delaying agents, and the like, compatible with pharmaceutical administration. Suitable carriers are described in the most recent edition of Remington's Pharmaceutical Sciences, a standard reference text in the field, which is incorporated herein by reference. Preferred examples of such carriers or diluents include, but are not limited to, water, saline, finger's solutions, dextrose solution, and 5%  
30 human serum albumin. Liposomes and non-aqueous vehicles such as fixed oils may also be used. The use of such media and agents for pharmaceutically active substances is well known in the art. Except insofar as any conventional media or agent is incompatible with the active compound, use thereof in the compositions is contemplated. Supplementary active compounds can also be incorporated into the compositions.

A pharmaceutical composition of the invention is formulated to be compatible with its intended route of administration. Examples of routes of administration include parenteral, *e.g.*, intravenous, intradermal, subcutaneous, oral (*e.g.*, inhalation), transdermal (*i.e.*, topical), transmucosal, and rectal administration. Solutions or suspensions used for parenteral, 5 intradermal, or subcutaneous application can include the following components: a sterile diluent such as water for injection, saline solution, fixed oils, polyethylene glycols, glycerine, propylene glycol or other synthetic solvents; antibacterial agents such as benzyl alcohol or methyl parabens; antioxidants such as ascorbic acid or sodium bisulfite; chelating agents such as ethylenediaminetetraacetic acid (EDTA); buffers such as acetates, citrates or phosphates, 10 and agents for the adjustment of tonicity such as sodium chloride or dextrose. The pH can be adjusted with acids or bases, such as hydrochloric acid or sodium hydroxide. The parenteral preparation can be enclosed in ampoules, disposable syringes or multiple dose vials made of glass or plastic.

Pharmaceutical compositions suitable for injectable use include sterile aqueous 15 solutions (where water soluble) or dispersions and sterile powders for the extemporaneous preparation of sterile injectable solutions or dispersion. For intravenous administration, suitable carriers include physiological saline, bacteriostatic water, Cremophor EL™ (BASF, Parsippany, N.J.) or phosphate buffered saline (PBS). In all cases, the composition must be sterile and should be fluid to the extent that easy syringeability exists. It must be stable under 20 the conditions of manufacture and storage and must be preserved against the contaminating action of microorganisms such as bacteria and fungi. The carrier can be a solvent or dispersion medium containing, for example, water, ethanol, polyol (for example, glycerol, propylene glycol, and liquid polyethylene glycol, and the like), and suitable mixtures thereof. The proper fluidity can be maintained, for example, by the use of a coating such as lecithin, by 25 the maintenance of the required particle size in the case of dispersion and by the use of surfactants. Prevention of the action of microorganisms can be achieved by various antibacterial and antifungal agents, for example, parabens, chlorobutanol, phenol, ascorbic acid, thimerosal, and the like. In many cases, it will be preferable to include isotonic agents, for example, sugars, polyalcohols such as manitol, sorbitol, sodium chloride in the 30 composition. Prolonged absorption of the injectable compositions can be brought about by including in the composition an agent which delays absorption, for example, aluminum monostearate and gelatin.

Sterile injectable solutions can be prepared by incorporating the active compound (*e.g.*, an NOVX protein or anti-NOVX antibody) in the required amount in an appropriate solvent

with one or a combination of ingredients enumerated above, as required, followed by filtered sterilization. Generally, dispersions are prepared by incorporating the active compound into a sterile vehicle that contains a basic dispersion medium and the required other ingredients from those enumerated above. In the case of sterile powders for the preparation of sterile injectable solutions, methods of preparation are vacuum drying and freeze-drying that yields a powder of the active ingredient plus any additional desired ingredient from a previously sterile-filtered solution thereof.

Oral compositions generally include an inert diluent or an edible carrier. They can be enclosed in gelatin capsules or compressed into tablets. For the purpose of oral therapeutic administration, the active compound can be incorporated with excipients and used in the form of tablets, troches, or capsules. Oral compositions can also be prepared using a fluid carrier for use as a mouthwash, wherein the compound in the fluid carrier is applied orally and swished and expectorated or swallowed. Pharmaceutically compatible binding agents, and/or adjuvant materials can be included as part of the composition. The tablets, pills, capsules, troches and the like can contain any of the following ingredients, or compounds of a similar nature: a binder such as microcrystalline cellulose, gum tragacanth or gelatin; an excipient such as starch or lactose, a disintegrating agent such as alginic acid, Primogel, or corn starch; a lubricant such as magnesium stearate or Sterotes; a glidant such as colloidal silicon dioxide; a sweetening agent such as sucrose or saccharin; or a flavoring agent such as peppermint, methyl salicylate, or orange flavoring.

For administration by inhalation, the compounds are delivered in the form of an aerosol spray from pressured container or dispenser which contains a suitable propellant, *e.g.*, a gas such as carbon dioxide, or a nebulizer.

Systemic administration can also be by transmucosal or transdermal means. For transmucosal or transdermal administration, penetrants appropriate to the barrier to be permeated are used in the formulation. Such penetrants are generally known in the art, and include, for example, for transmucosal administration, detergents, bile salts, and fusidic acid derivatives. Transmucosal administration can be accomplished through the use of nasal sprays or suppositories. For transdermal administration, the active compounds are formulated into ointments, salves, gels, or creams as generally known in the art.

The compounds can also be prepared in the form of suppositories (*e.g.*, with conventional suppository bases such as cocoa butter and other glycerides) or retention enemas for rectal delivery.

In one embodiment, the active compounds are prepared with carriers that will protect the compound against rapid elimination from the body, such as a controlled release formulation, including implants and microencapsulated delivery systems. Biodegradable, biocompatible polymers can be used, such as ethylene vinyl acetate, polyanhydrides, polyglycolic acid, collagen, polyorthoesters, and polylactic acid. Methods for preparation of such formulations will be apparent to those skilled in the art. The materials can also be obtained commercially from Alza Corporation and Nova Pharmaceuticals, Inc. Liposomal suspensions (including liposomes targeted to infected cells with monoclonal antibodies to viral antigens) can also be used as pharmaceutically acceptable carriers. These can be prepared according to methods known to those skilled in the art, for example, as described in U.S. Patent No. 4,522,811.

It is especially advantageous to formulate oral or parenteral compositions in dosage unit form for ease of administration and uniformity of dosage. Dosage unit form as used herein refers to physically discrete units suited as unitary dosages for the subject to be treated; each unit containing a predetermined quantity of active compound calculated to produce the desired therapeutic effect in association with the required pharmaceutical carrier. The specification for the dosage unit forms of the invention are dictated by and directly dependent on the unique characteristics of the active compound and the particular therapeutic effect to be achieved, and the limitations inherent in the art of compounding such an active compound for the treatment of individuals.

The nucleic acid molecules of the invention can be inserted into vectors and used as gene therapy vectors. Gene therapy vectors can be delivered to a subject by, for example, intravenous injection, local administration (*see, e.g.*, U.S. Patent No. 5,328,470) or by stereotactic injection (*see, e.g.*, Chen, *et al.*, 1994. *Proc. Natl. Acad. Sci. USA* 91: 3054-3057). The pharmaceutical preparation of the gene therapy vector can include the gene therapy vector in an acceptable diluent, or can comprise a slow release matrix in which the gene delivery vehicle is imbedded. Alternatively, where the complete gene delivery vector can be produced intact from recombinant cells, *e.g.*, retroviral vectors, the pharmaceutical preparation can include one or more cells that produce the gene delivery system.

The pharmaceutical compositions can be included in a container, pack, or dispenser together with instructions for administration.

### Screening and Detection Methods

The isolated nucleic acid molecules of the invention can be used to express NOVX protein (*e.g.*, via a recombinant expression vector in a host cell in gene therapy applications),

to detect NOVX mRNA (*e.g.*, in a biological sample) or a genetic lesion in an NOVX gene, and to modulate NOVX activity, as described further, below. In addition, the NOVX proteins can be used to screen drugs or compounds that modulate the NOVX protein activity or expression as well as to treat disorders characterized by insufficient or excessive production of NOVX protein or production of NOVX protein forms that have decreased or aberrant activity compared to NOVX wild-type protein (*e.g.*; diabetes (regulates insulin release); obesity (binds and transport lipids); metabolic disturbances associated with obesity, the metabolic syndrome X as well as anorexia and wasting disorders associated with chronic diseases and various cancers, and infectious disease (possesses anti-microbial activity) and the various dyslipidemias. In addition, the anti-NOVX antibodies of the invention can be used to detect and isolate NOVX proteins and modulate NOVX activity. In yet a further aspect, the invention can be used in methods to influence appetite, absorption of nutrients and the disposition of metabolic substrates in both a positive and negative fashion.

The invention further pertains to novel agents identified by the screening assays described herein and uses thereof for treatments as described, *supra*.

#### Screening Assays

The invention provides a method (also referred to herein as a "screening assay") for identifying modulators, *i.e.*, candidate or test compounds or agents (*e.g.*, peptides, peptidomimetics, small molecules or other drugs) that bind to NOVX proteins or have a stimulatory or inhibitory effect on, *e.g.*, NOVX protein expression or NOVX protein activity. The invention also includes compounds identified in the screening assays described herein. In one embodiment, the invention provides assays for screening candidate or test compounds which bind to or modulate the activity of the membrane-bound form of an NOVX protein or polypeptide or biologically-active portion thereof. The test compounds of the invention can be obtained using any of the numerous approaches in combinatorial library methods known in the art, including: biological libraries; spatially addressable parallel solid phase or solution phase libraries; synthetic library methods requiring deconvolution; the "one-bead one-compound" library method; and synthetic library methods using affinity chromatography selection. The biological library approach is limited to peptide libraries, while the other four approaches are applicable to peptide, non-peptide oligomer or small molecule libraries of compounds. *See, e.g.*, Lam, 1997. *Anticancer Drug Design* 12: 145.

A "small molecule" as used herein, is meant to refer to a composition that has a molecular weight of less than about 5 kD and most preferably less than about 4 kD. Small molecules can be, *e.g.*, nucleic acids, peptides, polypeptides, peptidomimetics, carbohydrates,

lipids or other organic or inorganic molecules. Libraries of chemical and/or biological mixtures, such as fungal, bacterial, or algal extracts, are known in the art and can be screened with any of the assays of the invention.

Examples of methods for the synthesis of molecular libraries can be found in the art, for example in: DeWitt, *et al.*, 1993. *Proc. Natl. Acad. Sci. U.S.A.* 90: 6909; Erb, *et al.*, 1994. *Proc. Natl. Acad. Sci. U.S.A.* 91: 11422; Zuckermann, *et al.*, 1994. *J. Med. Chem.* 37: 2678; Cho, *et al.*, 1993. *Science* 261: 1303; Carrell, *et al.*, 1994. *Angew. Chem. Int. Ed. Engl.* 33: 2059; Carell, *et al.*, 1994. *Angew. Chem. Int. Ed. Engl.* 33: 2061; and Gallop, *et al.*, 1994. *J. Med. Chem.* 37: 1233.

Libraries of compounds may be presented in solution (*e.g.*, Houghten, 1992. *Biotechniques* 13: 412-421), or on beads (Lam, 1991. *Nature* 354: 82-84), on chips (Fodor, 1993. *Nature* 364: 555-556), bacteria (Ladner, U.S. Patent No. 5,223,409), spores (Ladner, U.S. Patent 5,233,409), plasmids (Cull, *et al.*, 1992. *Proc. Natl. Acad. Sci. USA* 89: 1865-1869) or on phage (Scott and Smith, 1990. *Science* 249: 386-390; Devlin, 1990. *Science* 249: 404-406; Cwirla, *et al.*, 1990. *Proc. Natl. Acad. Sci. U.S.A.* 87: 6378-6382; Felici, 1991. *J. Mol. Biol.* 222: 301-310; Ladner, U.S. Patent No. 5,233,409.).

In one embodiment, an assay is a cell-based assay in which a cell which expresses a membrane-bound form of NOVX protein, or a biologically-active portion thereof, on the cell surface is contacted with a test compound and the ability of the test compound to bind to an NOVX protein determined. The cell, for example, can be of mammalian origin or a yeast cell. Determining the ability of the test compound to bind to the NOVX protein can be accomplished, for example, by coupling the test compound with a radioisotope or enzymatic label such that binding of the test compound to the NOVX protein or biologically-active portion thereof can be determined by detecting the labeled compound in a complex. For example, test compounds can be labeled with  $^{125}\text{I}$ ,  $^{35}\text{S}$ ,  $^{14}\text{C}$ , or  $^3\text{H}$ , either directly or indirectly, and the radioisotope detected by direct counting of radioemission or by scintillation counting. Alternatively, test compounds can be enzymatically-labeled with, for example, horseradish peroxidase, alkaline phosphatase, or luciferase, and the enzymatic label detected by determination of conversion of an appropriate substrate to product. In one embodiment, the assay comprises contacting a cell which expresses a membrane-bound form of NOVX protein, or a biologically-active portion thereof, on the cell surface with a known compound which binds NOVX to form an assay mixture, contacting the assay mixture with a test compound, and determining the ability of the test compound to interact with an NOVX protein, wherein determining the ability of the test compound to interact with an NOVX protein comprises

determining the ability of the test compound to preferentially bind to NOVX protein or a biologically-active portion thereof as compared to the known compound.

In another embodiment, an assay is a cell-based assay comprising contacting a cell expressing a membrane-bound form of NOVX protein, or a biologically-active portion thereof, on the cell surface with a test compound and determining the ability of the test compound to modulate (*e.g.*, stimulate or inhibit) the activity of the NOVX protein or biologically-active portion thereof. Determining the ability of the test compound to modulate the activity of NOVX or a biologically-active portion thereof can be accomplished, for example, by determining the ability of the NOVX protein to bind to or interact with an NOVX target molecule. As used herein, a "target molecule" is a molecule with which an NOVX protein binds or interacts in nature, for example, a molecule on the surface of a cell which expresses an NOVX interacting protein, a molecule on the surface of a second cell, a molecule in the extracellular milieu, a molecule associated with the internal surface of a cell membrane or a cytoplasmic molecule. An NOVX target molecule can be a non-NOVX molecule or an NOVX protein or polypeptide of the invention. In one embodiment, an NOVX target molecule is a component of a signal transduction pathway that facilitates transduction of an extracellular signal (*e.g.* a signal generated by binding of a compound to a membrane-bound NOVX molecule) through the cell membrane and into the cell. The target, for example, can be a second intercellular protein that has catalytic activity or a protein that facilitates the association of downstream signaling molecules with NOVX.

Determining the ability of the NOVX protein to bind to or interact with an NOVX target molecule can be accomplished by one of the methods described above for determining direct binding. In one embodiment, determining the ability of the NOVX protein to bind to or interact with an NOVX target molecule can be accomplished by determining the activity of the target molecule. For example, the activity of the target molecule can be determined by detecting induction of a cellular second messenger of the target (*i.e.* intracellular  $\text{Ca}^{2+}$ , diacylglycerol,  $\text{IP}_3$ , etc.), detecting catalytic/enzymatic activity of the target an appropriate substrate, detecting the induction of a reporter gene (comprising an NOVX-responsive regulatory element operatively linked to a nucleic acid encoding a detectable marker, *e.g.*, luciferase), or detecting a cellular response, for example, cell survival, cellular differentiation, or cell proliferation.

In yet another embodiment, an assay of the invention is a cell-free assay comprising contacting an NOVX protein or biologically-active portion thereof with a test compound and determining the ability of the test compound to bind to the NOVX protein or biologically-

active portion thereof. Binding of the test compound to the NOVX protein can be determined either directly or indirectly as described above. In one such embodiment, the assay comprises contacting the NOVX protein or biologically-active portion thereof with a known compound which binds NOVX to form an assay mixture, contacting the assay mixture with a test  
5 compound, and determining the ability of the test compound to interact with an NOVX protein, wherein determining the ability of the test compound to interact with an NOVX protein comprises determining the ability of the test compound to preferentially bind to NOVX or biologically-active portion thereof as compared to the known compound.

In still another embodiment, an assay is a cell-free assay comprising contacting NOVX  
10 protein or biologically-active portion thereof with a test compound and determining the ability of the test compound to modulate (e.g. stimulate or inhibit) the activity of the NOVX protein or biologically-active portion thereof. Determining the ability of the test compound to modulate the activity of NOVX can be accomplished, for example, by determining the ability of the NOVX protein to bind to an NOVX target molecule by one of the methods described  
15 above for determining direct binding. In an alternative embodiment, determining the ability of the test compound to modulate the activity of NOVX protein can be accomplished by determining the ability of the NOVX protein further modulate an NOVX target molecule. For example, the catalytic/enzymatic activity of the target molecule on an appropriate substrate can be determined as described, *supra*.

In yet another embodiment, the cell-free assay comprises contacting the NOVX protein  
20 or biologically-active portion thereof with a known compound which binds NOVX protein to form an assay mixture, contacting the assay mixture with a test compound, and determining the ability of the test compound to interact with an NOVX protein, wherein determining the ability of the test compound to interact with an NOVX protein comprises determining the  
25 ability of the NOVX protein to preferentially bind to or modulate the activity of an NOVX target molecule.

The cell-free assays of the invention are amenable to use of both the soluble form or the membrane-bound form of NOVX protein. In the case of cell-free assays comprising the membrane-bound form of NOVX protein, it may be desirable to utilize a solubilizing agent  
30 such that the membrane-bound form of NOVX protein is maintained in solution. Examples of such solubilizing agents include non-ionic detergents such as n-octylglucoside, n-dodecylglucoside, n-dodecylmaltoside, octanoyl-N-methylglucamide, decanoyl-N-methylglucamide, Triton® X-100, Triton® X-114, Thesit®, Isotridecypoly(ethylene glycol ether)<sub>n</sub>, N-dodecyl--N,N-dimethyl-3-ammonio-1-propane



sulfonate, 3-(3-cholamidopropyl) dimethylamminiol-1-propane sulfonate (CHAPS), or 3-(3-cholamidopropyl)dimethylamminiol-2-hydroxy-1-propane sulfonate (CHAPSO).

In more than one embodiment of the above assay methods of the invention, it may be desirable to immobilize either NOVX protein or its target molecule to facilitate separation of complexed from uncomplexed forms of one or both of the proteins, as well as to accommodate automation of the assay. Binding of a test compound to NOVX protein, or interaction of NOVX protein with a target molecule in the presence and absence of a candidate compound, can be accomplished in any vessel suitable for containing the reactants. Examples of such vessels include microtiter plates, test tubes, and micro-centrifuge tubes. In one embodiment, a fusion protein can be provided that adds a domain that allows one or both of the proteins to be bound to a matrix. For example, GST-NOVX fusion proteins or GST-target fusion proteins can be adsorbed onto glutathione sepharose beads (Sigma Chemical, St. Louis, MO) or glutathione derivatized microtiter plates, that are then combined with the test compound or the test compound and either the non-adsorbed target protein or NOVX protein, and the mixture is incubated under conditions conducive to complex formation (*e.g.*, at physiological conditions for salt and pH). Following incubation, the beads or microtiter plate wells are washed to remove any unbound components, the matrix immobilized in the case of beads, complex determined either directly or indirectly, for example, as described, *supra*. Alternatively, the complexes can be dissociated from the matrix, and the level of NOVX protein binding or activity determined using standard techniques.

Other techniques for immobilizing proteins on matrices can also be used in the screening assays of the invention. For example, either the NOVX protein or its target molecule can be immobilized utilizing conjugation of biotin and streptavidin. Biotinylated NOVX protein or target molecules can be prepared from biotin-NHS (N-hydroxy-succinimide) using techniques well-known within the art (*e.g.*, biotinylation kit, Pierce Chemicals, Rockford, Ill.), and immobilized in the wells of streptavidin-coated 96 well plates (Pierce Chemical). Alternatively, antibodies reactive with NOVX protein or target molecules, but which do not interfere with binding of the NOVX protein to its target molecule, can be derivatized to the wells of the plate, and unbound target or NOVX protein trapped in the wells by antibody conjugation. Methods for detecting such complexes, in addition to those described above for the GST-immobilized complexes, include immunodetection of complexes using antibodies reactive with the NOVX protein or target molecule, as well as enzyme-linked assays that rely on detecting an enzymatic activity associated with the NOVX protein or target molecule.

In another embodiment, modulators of NOVX protein expression are identified in a method wherein a cell is contacted with a candidate compound and the expression of NOVX mRNA or protein in the cell is determined. The level of expression of NOVX mRNA or protein in the presence of the candidate compound is compared to the level of expression of NOVX mRNA or protein in the absence of the candidate compound. The candidate compound can then be identified as a modulator of NOVX mRNA or protein expression based upon this comparison. For example, when expression of NOVX mRNA or protein is greater (*i.e.*, statistically significantly greater) in the presence of the candidate compound than in its absence, the candidate compound is identified as a stimulator of NOVX mRNA or protein expression. Alternatively, when expression of NOVX mRNA or protein is less (statistically significantly less) in the presence of the candidate compound than in its absence, the candidate compound is identified as an inhibitor of NOVX mRNA or protein expression. The level of NOVX mRNA or protein expression in the cells can be determined by methods described herein for detecting NOVX mRNA or protein.

In yet another aspect of the invention, the NOVX proteins can be used as "bait proteins" in a two-hybrid assay or three hybrid assay (*see, e.g.*, U.S. Patent No. 5,283,317; Zervos, *et al.*, 1993. *Cell* 72: 223-232; Madura, *et al.*, 1993. *J. Biol. Chem.* 268: 12046-12054; Bartel, *et al.*, 1993. *Biotechniques* 14: 920-924; Iwabuchi, *et al.*, 1993. *Oncogene* 8: 1693-1696; and Brent WO 94/10300), to identify other proteins that bind to or interact with NOVX ("NOVX-binding proteins" or "NOVX-bp") and modulate NOVX activity. Such NOVX-binding proteins are also likely to be involved in the propagation of signals by the NOVX proteins as, for example, upstream or downstream elements of the NOVX pathway. The two-hybrid system is based on the modular nature of most transcription factors, which consist of separable DNA-binding and activation domains. Briefly, the assay utilizes two different DNA constructs. In one construct, the gene that codes for NOVX is fused to a gene encoding the DNA binding domain of a known transcription factor (*e.g.*, GAL-4). In the other construct, a DNA sequence, from a library of DNA sequences, that encodes an unidentified protein ("prey" or "sample") is fused to a gene that codes for the activation domain of the known transcription factor. If the "bait" and the "prey" proteins are able to interact, *in vivo*, forming an NOVX-dependent complex, the DNA-binding and activation domains of the transcription factor are brought into close proximity. This proximity allows transcription of a reporter gene (*e.g.*, LacZ) that is operably linked to a transcriptional regulatory site responsive to the transcription factor. Expression of the reporter gene can be detected and cell colonies

containing the functional transcription factor can be isolated and used to obtain the cloned gene that encodes the protein which interacts with NOVX.

The invention further pertains to novel agents identified by the aforementioned screening assays and uses thereof for treatments as described herein.

## 5     **Detection Assays**

Portions or fragments of the cDNA sequences identified herein (and the corresponding complete gene sequences) can be used in numerous ways as polynucleotide reagents. By way of example, and not of limitation, these sequences can be used to: (i) map their respective genes on a chromosome; and, thus, locate gene regions associated with genetic disease; (ii) 10     identify an individual from a minute biological sample (tissue typing); and (iii) aid in forensic identification of a biological sample. Some of these applications are described in the subsections, below.

### **Chromosome Mapping**

Once the sequence (or a portion of the sequence) of a gene has been isolated, this 15     sequence can be used to map the location of the gene on a chromosome. This process is called chromosome mapping. Accordingly, portions or fragments of the NOVX sequences, SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, or fragments or derivatives thereof, can be used to map the location of the NOVX genes, respectively, on a chromosome. The mapping of the NOVX sequences to 20     chromosomes is an important first step in correlating these sequences with genes associated with disease.

Briefly, NOVX genes can be mapped to chromosomes by preparing PCR primers (preferably 15-25 bp in length) from the NOVX sequences. Computer analysis of the NOVX, sequences can be used to rapidly select primers that do not span more than one exon in the 25     genomic DNA, thus complicating the amplification process. These primers can then be used for PCR screening of somatic cell hybrids containing individual human chromosomes. Only those hybrids containing the human gene corresponding to the NOVX sequences will yield an amplified fragment.

Somatic cell hybrids are prepared by fusing somatic cells from different mammals 30     (e.g., human and mouse cells). As hybrids of human and mouse cells grow and divide, they gradually lose human chromosomes in random order, but retain the mouse chromosomes. By using media in which mouse cells cannot grow, because they lack a particular enzyme, but in which human cells can, the one human chromosome that contains the gene encoding the

needed enzyme will be retained. By using various media, panels of hybrid cell lines can be established. Each cell line in a panel contains either a single human chromosome or a small number of human chromosomes, and a full set of mouse chromosomes, allowing easy mapping of individual genes to specific human chromosomes. See, e.g., D'Eustachio, *et al.*, 1983. *Science* 220: 919-924. Somatic cell hybrids containing only fragments of human chromosomes can also be produced by using human chromosomes with translocations and deletions.

PCR mapping of somatic cell hybrids is a rapid procedure for assigning a particular sequence to a particular chromosome. Three or more sequences can be assigned per day using a single thermal cycler. Using the NOVX sequences to design oligonucleotide primers, sub-localization can be achieved with panels of fragments from specific chromosomes.

Fluorescence *in situ* hybridization (FISH) of a DNA sequence to a metaphase chromosomal spread can further be used to provide a precise chromosomal location in one step. Chromosome spreads can be made using cells whose division has been blocked in metaphase by a chemical like colcemid that disrupts the mitotic spindle. The chromosomes can be treated briefly with trypsin, and then stained with Giemsa. A pattern of light and dark bands develops on each chromosome, so that the chromosomes can be identified individually. The FISH technique can be used with a DNA sequence as short as 500 or 600 bases. However, clones larger than 1,000 bases have a higher likelihood of binding to a unique chromosomal location with sufficient signal intensity for simple detection. Preferably 1,000 bases, and more preferably 2,000 bases, will suffice to get good results at a reasonable amount of time. For a review of this technique, see, Verma, *et al.*, HUMAN CHROMOSOMES: A MANUAL OF BASIC TECHNIQUES (Pergamon Press, New York 1988).

Reagents for chromosome mapping can be used individually to mark a single chromosome or a single site on that chromosome, or panels of reagents can be used for marking multiple sites and/or multiple chromosomes. Reagents corresponding to noncoding regions of the genes actually are preferred for mapping purposes. Coding sequences are more likely to be conserved within gene families, thus increasing the chance of cross hybridizations during chromosomal mapping.

Once a sequence has been mapped to a precise chromosomal location, the physical position of the sequence on the chromosome can be correlated with genetic map data. Such data are found, e.g., in McKusick, MENDELIAN INHERITANCE IN MAN, available on-line through Johns Hopkins University Welch Medical Library). The relationship between genes and disease, mapped to the same chromosomal region, can then be identified through linkage

analysis (co-inheritance of physically adjacent genes), described in, *e.g.*, Egeland, *et al.*, 1987. *Nature*, 325: 783-787.

Moreover, differences in the DNA sequences between individuals affected and unaffected with a disease associated with the NOVX gene, can be determined. If a mutation is  
5 observed in some or all of the affected individuals but not in any unaffected individuals, then the mutation is likely to be the causative agent of the particular disease. Comparison of affected and unaffected individuals generally involves first looking for structural alterations in the chromosomes, such as deletions or translocations that are visible from chromosome  
10 spreads or detectable using PCR based on that DNA sequence. Ultimately, complete sequencing of genes from several individuals can be performed to confirm the presence of a mutation and to distinguish mutations from polymorphisms.

### Tissue Typing

The NOVX sequences of the invention can also be used to identify individuals from minute biological samples. In this technique, an individual's genomic DNA is digested with  
15 one or more restriction enzymes, and probed on a Southern blot to yield unique bands for identification. The sequences of the invention are useful as additional DNA markers for RFLP ("restriction fragment length polymorphisms," described in U.S. Patent No. 5,272,057). Furthermore, the sequences of the invention can be used to provide an alternative technique that determines the actual base-by-base DNA sequence of selected portions of an individual's  
20 genome. Thus, the NOVX sequences described herein can be used to prepare two PCR primers from the 5'- and 3'-termini of the sequences. These primers can then be used to amplify an individual's DNA and subsequently sequence it.

Panels of corresponding DNA sequences from individuals, prepared in this manner, can provide unique individual identifications, as each individual will have a unique set of such  
25 DNA sequences due to allelic differences. The sequences of the invention can be used to obtain such identification sequences from individuals and from tissue. The NOVX sequences of the invention uniquely represent portions of the human genome. Allelic variation occurs to some degree in the coding regions of these sequences, and to a greater degree in the noncoding regions. It is estimated that allelic variation between individual humans occurs with a  
30 frequency of about once per each 500 bases. Much of the allelic variation is due to single nucleotide polymorphisms (SNPs), which include restriction fragment length polymorphisms (RFLPs).

Each of the sequences described herein can, to some degree, be used as a standard against which DNA from an individual can be compared for identification purposes. Because

greater numbers of polymorphisms occur in the noncoding regions, fewer sequences are necessary to differentiate individuals. The noncoding sequences can comfortably provide positive individual identification with a panel of perhaps 10 to 1,000 primers that each yield a noncoding amplified sequence of 100 bases. If predicted coding sequences, such as those in SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59 are used, a more appropriate number of primers for positive individual identification would be 500-2,000.

### **Predictive Medicine**

The invention also pertains to the field of predictive medicine in which diagnostic assays, prognostic assays, pharmacogenomics, and monitoring clinical trials are used for prognostic (predictive) purposes to thereby treat an individual prophylactically. Accordingly, one aspect of the invention relates to diagnostic assays for determining NOVX protein and/or nucleic acid expression as well as NOVX activity, in the context of a biological sample (*e.g.*, blood, serum, cells, tissue) to thereby determine whether an individual is afflicted with a disease or disorder, or is at risk of developing a disorder, associated with aberrant NOVX expression or activity. The disorders include metabolic disorders, diabetes, obesity, infectious disease, anorexia, cancer-associated cachexia, cancer, neurodegenerative disorders, Alzheimer's Disease, Parkinson's Disorder, immune disorders, and hematopoietic disorders, and the various dyslipidemias, metabolic disturbances associated with obesity, the metabolic syndrome X and wasting disorders associated with chronic diseases and various cancers. The invention also provides for prognostic (or predictive) assays for determining whether an individual is at risk of developing a disorder associated with NOVX protein, nucleic acid expression or activity. For example, mutations in an NOVX gene can be assayed in a biological sample. Such assays can be used for prognostic or predictive purpose to thereby prophylactically treat an individual prior to the onset of a disorder characterized by or associated with NOVX protein, nucleic acid expression, or biological activity.

Another aspect of the invention provides methods for determining NOVX protein, nucleic acid expression or activity in an individual to thereby select appropriate therapeutic or prophylactic agents for that individual (referred to herein as "pharmacogenomics").

Pharmacogenomics allows for the selection of agents (*e.g.*, drugs) for therapeutic or prophylactic treatment of an individual based on the genotype of the individual (*e.g.*, the genotype of the individual examined to determine the ability of the individual to respond to a particular agent.)

Yet another aspect of the invention pertains to monitoring the influence of agents (*e.g.*, drugs, compounds) on the expression or activity of NOVX in clinical trials. These and other agents are described in further detail in the following sections.

### Diagnostic Assays

5           An exemplary method for detecting the presence or absence of NOVX in a biological sample involves obtaining a biological sample from a test subject and contacting the biological sample with a compound or an agent capable of detecting NOVX protein or nucleic acid (*e.g.*, mRNA, genomic DNA) that encodes NOVX protein such that the presence of NOVX is detected in the biological sample. An agent for detecting NOVX mRNA or genomic DNA is a  
10    labeled nucleic acid probe capable of hybridizing to NOVX mRNA or genomic DNA. The nucleic acid probe can be, for example, a full-length NOVX nucleic acid, such as the nucleic acid of SEQ ID NOS: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, and 59, or a portion thereof, such as an oligonucleotide of at least 15, 30, 50, 100, 250 or 500 nucleotides in length and sufficient to specifically hybridize  
15    under stringent conditions to NOVX mRNA or genomic DNA. Other suitable probes for use in the diagnostic assays of the invention are described herein.

          An agent for detecting NOVX protein is an antibody capable of binding to NOVX protein, preferably an antibody with a detectable label. Antibodies can be polyclonal, or more preferably, monoclonal. An intact antibody, or a fragment thereof (*e.g.*, Fab or F(ab')<sub>2</sub>) can be  
20    used. The term "labeled", with regard to the probe or antibody, is intended to encompass direct labeling of the probe or antibody by coupling (*i.e.*, physically linking) a detectable substance to the probe or antibody, as well as indirect labeling of the probe or antibody by reactivity with another reagent that is directly labeled. Examples of indirect labeling include detection of a primary antibody using a fluorescently-labeled secondary antibody and  
25    end-labeling of a DNA probe with biotin such that it can be detected with fluorescently-labeled streptavidin. The term "biological sample" is intended to include tissues, cells and biological fluids isolated from a subject, as well as tissues, cells and fluids present within a subject. That is, the detection method of the invention can be used to detect NOVX mRNA, protein, or genomic DNA in a biological sample *in vitro* as well as *in vivo*. For example, *in*  
30    *vitro* techniques for detection of NOVX mRNA include Northern hybridizations and *in situ* hybridizations. *In vitro* techniques for detection of NOVX protein include enzyme linked immunosorbent assays (ELISAs), Western blots, immunoprecipitations, and immunofluorescence. *In vitro* techniques for detection of NOVX genomic DNA include Southern hybridizations. Furthermore, *in vivo* techniques for detection of NOVX protein

include introducing into a subject a labeled anti-NOVX antibody. For example, the antibody can be labeled with a radioactive marker whose presence and location in a subject can be detected by standard imaging techniques.

5 In one embodiment, the biological sample contains protein molecules from the test subject. Alternatively, the biological sample can contain mRNA molecules from the test subject or genomic DNA molecules from the test subject. A preferred biological sample is a peripheral blood leukocyte sample isolated by conventional means from a subject.

10 In another embodiment, the methods further involve obtaining a control biological sample from a control subject, contacting the control sample with a compound or agent capable of detecting NOVX protein, mRNA, or genomic DNA, such that the presence of NOVX protein, mRNA or genomic DNA is detected in the biological sample, and comparing the presence of NOVX protein, mRNA or genomic DNA in the control sample with the presence of NOVX protein, mRNA or genomic DNA in the test sample.

15 The invention also encompasses kits for detecting the presence of NOVX in a biological sample. For example, the kit can comprise: a labeled compound or agent capable of detecting NOVX protein or mRNA in a biological sample; means for determining the amount of NOVX in the sample; and means for comparing the amount of NOVX in the sample with a standard. The compound or agent can be packaged in a suitable container. The kit can further comprise instructions for using the kit to detect NOVX protein or nucleic acid.

## 20 **Prognostic Assays**

The diagnostic methods described herein can furthermore be utilized to identify subjects having or at risk of developing a disease or disorder associated with aberrant NOVX expression or activity. For example, the assays described herein, such as the preceding diagnostic assays or the following assays, can be utilized to identify a subject having or at risk  
25 of developing a disorder associated with NOVX protein, nucleic acid expression or activity. Alternatively, the prognostic assays can be utilized to identify a subject having or at risk for developing a disease or disorder. Thus, the invention provides a method for identifying a disease or disorder associated with aberrant NOVX expression or activity in which a test sample is obtained from a subject and NOVX protein or nucleic acid (*e.g.*, mRNA, genomic  
30 DNA) is detected, wherein the presence of NOVX protein or nucleic acid is diagnostic for a subject having or at risk of developing a disease or disorder associated with aberrant NOVX expression or activity. As used herein, a "test sample" refers to a biological sample obtained from a subject of interest. For example, a test sample can be a biological fluid (*e.g.*, serum), cell sample, or tissue.



Furthermore, the prognostic assays described herein can be used to determine whether a subject can be administered an agent (e.g., an agonist, antagonist, peptidomimetic, protein, peptide, nucleic acid, small molecule, or other drug candidate) to treat a disease or disorder associated with aberrant NOVX expression or activity. For example, such methods can be used to determine whether a subject can be effectively treated with an agent for a disorder. Thus, the invention provides methods for determining whether a subject can be effectively treated with an agent for a disorder associated with aberrant NOVX expression or activity in which a test sample is obtained and NOVX protein or nucleic acid is detected (e.g., wherein the presence of NOVX protein or nucleic acid is diagnostic for a subject that can be administered the agent to treat a disorder associated with aberrant NOVX expression or activity).

The methods of the invention can also be used to detect genetic lesions in an NOVX gene, thereby determining if a subject with the lesioned gene is at risk for a disorder characterized by aberrant cell proliferation and/or differentiation. In various embodiments, the methods include detecting, in a sample of cells from the subject, the presence or absence of a genetic lesion characterized by at least one of an alteration affecting the integrity of a gene encoding an NOVX-protein, or the misexpression of the NOVX gene. For example, such genetic lesions can be detected by ascertaining the existence of at least one of: (i) a deletion of one or more nucleotides from an NOVX gene; (ii) an addition of one or more nucleotides to an NOVX gene; (iii) a substitution of one or more nucleotides of an NOVX gene, (iv) a chromosomal rearrangement of an NOVX gene; (v) an alteration in the level of a messenger RNA transcript of an NOVX gene, (vi) aberrant modification of an NOVX gene, such as of the methylation pattern of the genomic DNA, (vii) the presence of a non-wild-type splicing pattern of a messenger RNA transcript of an NOVX gene, (viii) a non-wild-type level of an NOVX protein, (ix) allelic loss of an NOVX gene, and (x) inappropriate post-translational modification of an NOVX protein. As described herein, there are a large number of assay techniques known in the art which can be used for detecting lesions in an NOVX gene. A preferred biological sample is a peripheral blood leukocyte sample isolated by conventional means from a subject. However, any biological sample containing nucleated cells may be used, including, for example, buccal mucosal cells.

In certain embodiments, detection of the lesion involves the use of a probe/primer in a polymerase chain reaction (PCR) (*see, e.g.*, U.S. Patent Nos. 4,683,195 and 4,683,202), such as anchor PCR or RACE PCR, or, alternatively, in a ligation chain reaction (LCR) (*see, e.g.*, Landegran, *et al.*, 1988. *Science* 241: 1077-1080; and Nakazawa, *et al.*, 1994. *Proc. Natl.*

*Acad. Sci. USA* 91: 360-364), the latter of which can be particularly useful for detecting point mutations in the NOVX-gene (see, Abravaya, *et al.*, 1995. *Nucl. Acids Res.* 23: 675-682).

This method can include the steps of collecting a sample of cells from a patient, isolating nucleic acid (*e.g.*, genomic, mRNA or both) from the cells of the sample, contacting the nucleic acid sample with one or more primers that specifically hybridize to an NOVX gene under conditions such that hybridization and amplification of the NOVX gene (if present) occurs, and detecting the presence or absence of an amplification product, or detecting the size of the amplification product and comparing the length to a control sample. It is anticipated that PCR and/or LCR may be desirable to use as a preliminary amplification step in conjunction with any of the techniques used for detecting mutations described herein. Alternative amplification methods include: self sustained sequence replication (see, Guatelli, *et al.*, 1990. *Proc. Natl. Acad. Sci. USA* 87: 1874-1878), transcriptional amplification system (see, Kwoh, *et al.*, 1989. *Proc. Natl. Acad. Sci. USA* 86: 1173-1177); Q $\beta$  Replicase (see, Lizardi, *et al.*, 1988. *BioTechnology* 6: 1197), or any other nucleic acid amplification method, followed by the detection of the amplified molecules using techniques well known to those of skill in the art. These detection schemes are especially useful for the detection of nucleic acid molecules if such molecules are present in very low numbers.

In an alternative embodiment, mutations in an NOVX gene from a sample cell can be identified by alterations in restriction enzyme cleavage patterns. For example, sample and control DNA is isolated, amplified (optionally), digested with one or more restriction endonucleases, and fragment length sizes are determined by gel electrophoresis and compared. Differences in fragment length sizes between sample and control DNA indicates mutations in the sample DNA. Moreover, the use of sequence specific ribozymes (see, *e.g.*, U.S. Patent No. 5,493,531) can be used to score for the presence of specific mutations by development or loss of a ribozyme cleavage site.

In other embodiments, genetic mutations in NOVX can be identified by hybridizing a sample and control nucleic acids, *e.g.*, DNA or RNA, to high-density arrays containing hundreds or thousands of oligonucleotides probes. See, *e.g.*, Cronin, *et al.*, 1996. *Human Mutation* 7: 244-255; Kozal, *et al.*, 1996. *Nat. Med.* 2: 753-759. For example, genetic mutations in NOVX can be identified in two dimensional arrays containing light-generated DNA probes as described in Cronin, *et al.*, *supra*. Briefly, a first hybridization array of probes can be used to scan through long stretches of DNA in a sample and control to identify base changes between the sequences by making linear arrays of sequential overlapping probes. This step allows the identification of point mutations. This is followed by a second

hybridization array that allows the characterization of specific mutations by using smaller, specialized probe arrays complementary to all variants or mutations detected. Each mutation array is composed of parallel probe sets, one complementary to the wild-type gene and the other complementary to the mutant gene.

5           In yet another embodiment, any of a variety of sequencing reactions known in the art can be used to directly sequence the NOVX gene and detect mutations by comparing the sequence of the sample NOVX with the corresponding wild-type (control) sequence. Examples of sequencing reactions include those based on techniques developed by Maxim and Gilbert, 1977. *Proc. Natl. Acad. Sci. USA* 74: 560 or Sanger, 1977. *Proc. Natl. Acad. Sci. USA* 10 74: 5463. It is also contemplated that any of a variety of automated sequencing procedures can be utilized when performing the diagnostic assays (*see, e.g.*, Naeve, *et al.*, 1995. *Biotechniques* 19: 448), including sequencing by mass spectrometry (*see, e.g.*, PCT International Publication No. WO 94/16101; Cohen, *et al.*, 1996. *Adv. Chromatography* 36: 127-162; and Griffin, *et al.*, 1993. *Appl. Biochem. Biotechnol.* 38: 147-159).

15           Other methods for detecting mutations in the NOVX gene include methods in which protection from cleavage agents is used to detect mismatched bases in RNA/RNA or RNA/DNA heteroduplexes. *See, e.g.*, Myers, *et al.*, 1985. *Science* 230: 1242. In general, the art technique of "mismatch cleavage" starts by providing heteroduplexes of formed by hybridizing (labeled) RNA or DNA containing the wild-type NOVX sequence with potentially 20 mutant RNA or DNA obtained from a tissue sample. The double-stranded duplexes are treated with an agent that cleaves single-stranded regions of the duplex such as which will exist due to basepair mismatches between the control and sample strands. For instance, RNA/DNA duplexes can be treated with RNase and DNA/DNA hybrids treated with S<sub>1</sub> nuclease to enzymatically digesting the mismatched regions. In other embodiments, either 25 DNA/DNA or RNA/DNA duplexes can be treated with hydroxylamine or osmium tetroxide and with piperidine in order to digest mismatched regions. After digestion of the mismatched regions, the resulting material is then separated by size on denaturing polyacrylamide gels to determine the site of mutation. *See, e.g.*, Cotton, *et al.*, 1988. *Proc. Natl. Acad. Sci. USA* 85: 4397; Saleeba, *et al.*, 1992. *Methods Enzymol.* 217: 286-295. In an embodiment, the control 30 DNA or RNA can be labeled for detection.

          In still another embodiment, the mismatch cleavage reaction employs one or more proteins that recognize mismatched base pairs in double-stranded DNA (so called "DNA mismatch repair" enzymes) in defined systems for detecting and mapping point mutations in NOVX cDNAs obtained from samples of cells. For example, the mutY enzyme of *E. coli*

cleaves A at G/A mismatches and the thymidine DNA glycosylase from HeLa cells cleaves T at G/T mismatches. *See, e.g., Hsu, et al., 1994. Carcinogenesis 15: 1657-1662.* According to an exemplary embodiment, a probe based on an NOVX sequence, *e.g., a wild-type NOVX sequence*, is hybridized to a cDNA or other DNA product from a test cell(s). The duplex is treated with a DNA mismatch repair enzyme, and the cleavage products, if any, can be detected from electrophoresis protocols or the like. *See, e.g., U.S. Patent No. 5,459,039.*

In other embodiments, alterations in electrophoretic mobility will be used to identify mutations in NOVX genes. For example, single strand conformation polymorphism (SSCP) may be used to detect differences in electrophoretic mobility between mutant and wild type nucleic acids. *See, e.g., Orita, et al., 1989. Proc. Natl. Acad. Sci. USA: 86: 2766; Cotton, 1993. Mutat. Res. 285: 125-144; Hayashi, 1992. Genet. Anal. Tech. Appl. 9: 73-79.* Single-stranded DNA fragments of sample and control NOVX nucleic acids will be denatured and allowed to renature. The secondary structure of single-stranded nucleic acids varies according to sequence, the resulting alteration in electrophoretic mobility enables the detection of even a single base change. The DNA fragments may be labeled or detected with labeled probes. The sensitivity of the assay may be enhanced by using RNA (rather than DNA), in which the secondary structure is more sensitive to a change in sequence. In one embodiment, the subject method utilizes heteroduplex analysis to separate double stranded heteroduplex molecules on the basis of changes in electrophoretic mobility. *See, e.g., Keen, et al., 1991. Trends Genet. 7: 5.*

In yet another embodiment, the movement of mutant or wild-type fragments in polyacrylamide gels containing a gradient of denaturant is assayed using denaturing gradient gel electrophoresis (DGGE). *See, e.g., Myers, et al., 1985. Nature 313: 495.* When DGGE is used as the method of analysis, DNA will be modified to insure that it does not completely denature, for example by adding a GC clamp of approximately 40 bp of high-melting GC-rich DNA by PCR. In a further embodiment, a temperature gradient is used in place of a denaturing gradient to identify differences in the mobility of control and sample DNA. *See, e.g., Rosenbaum and Reissner, 1987. Biophys. Chem. 265: 12753.*

Examples of other techniques for detecting point mutations include, but are not limited to, selective oligonucleotide hybridization, selective amplification, or selective primer extension. For example, oligonucleotide primers may be prepared in which the known mutation is placed centrally and then hybridized to target DNA under conditions that permit hybridization only if a perfect match is found. *See, e.g., Saiki, et al., 1986. Nature 324: 163; Saiki, et al., 1989. Proc. Natl. Acad. Sci. USA 86: 6230.* Such allele specific oligonucleotides

are hybridized to PCR amplified target DNA or a number of different mutations when the oligonucleotides are attached to the hybridizing membrane and hybridized with labeled target DNA.

Alternatively, allele specific amplification technology that depends on selective PCR amplification may be used in conjunction with the instant invention. Oligonucleotides used as primers for specific amplification may carry the mutation of interest in the center of the molecule (so that amplification depends on differential hybridization; *see, e.g., Gibbs, et al., 1989. Nucl. Acids Res. 17: 2437-2448*) or at the extreme 3'-terminus of one primer where, under appropriate conditions, mismatch can prevent, or reduce polymerase extension (*see, e.g., Prossner, 1993. Tibtech. 11: 238*). In addition it may be desirable to introduce a novel restriction site in the region of the mutation to create cleavage-based detection. *See, e.g., Gasparini, et al., 1992. Mol. Cell Probes 6: 1*. It is anticipated that in certain embodiments amplification may also be performed using *Taq* ligase for amplification. *See, e.g., Barany, 1991. Proc. Natl. Acad. Sci. USA 88: 189*. In such cases, ligation will occur only if there is a perfect match at the 3'-terminus of the 5' sequence, making it possible to detect the presence of a known mutation at a specific site by looking for the presence or absence of amplification. The methods described herein may be performed, for example, by utilizing pre-packaged diagnostic kits comprising at least one probe nucleic acid or antibody reagent described herein, which may be conveniently used, *e.g.,* in clinical settings to diagnose patients exhibiting symptoms or family history of a disease or illness involving an NOVX gene.

Furthermore, any cell type or tissue, preferably peripheral blood leukocytes, in which NOVX is expressed may be utilized in the prognostic assays described herein. However, any biological sample containing nucleated cells may be used, including, for example, buccal mucosal cells.

## 25 **Pharmacogenomics**

Agents, or modulators that have a stimulatory or inhibitory effect on NOVX activity (*e.g.,* NOVX gene expression), as identified by a screening assay described herein can be administered to individuals to treat (prophylactically or therapeutically) disorders (The disorders include metabolic disorders, diabetes, obesity, infectious disease, anorexia, cancer-associated cachexia, cancer, neurodegenerative disorders, Alzheimer's Disease, Parkinson's Disorder, immune disorders, and hematopoietic disorders, and the various dyslipidemias, metabolic disturbances associated with obesity, the metabolic syndrome X and wasting disorders associated with chronic diseases and various cancers.) In conjunction with such treatment, the pharmacogenomics (*i.e.,* the study of the relationship between an individual's

genotype and that individual's response to a foreign compound or drug) of the individual may be considered. Differences in metabolism of therapeutics can lead to severe toxicity or therapeutic failure by altering the relation between dose and blood concentration of the pharmacologically active drug. Thus, the pharmacogenomics of the individual permits the selection of effective agents (*e.g.*, drugs) for prophylactic or therapeutic treatments based on a consideration of the individual's genotype. Such pharmacogenomics can further be used to determine appropriate dosages and therapeutic regimens. Accordingly, the activity of NOVX protein, expression of NOVX nucleic acid, or mutation content of NOVX genes in an individual can be determined to thereby select appropriate agent(s) for therapeutic or prophylactic treatment of the individual.

Pharmacogenomics deals with clinically significant hereditary variations in the response to drugs due to altered drug disposition and abnormal action in affected persons. See *e.g.*, Eichelbaum, 1996. *Clin. Exp. Pharmacol. Physiol.*, 23: 983-985; Linder, 1997. *Clin. Chem.*, 43: 254-266. In general, two types of pharmacogenetic conditions can be differentiated. Genetic conditions transmitted as a single factor altering the way drugs act on the body (altered drug action) or genetic conditions transmitted as single factors altering the way the body acts on drugs (altered drug metabolism). These pharmacogenetic conditions can occur either as rare defects or as polymorphisms. For example, glucose-6-phosphate dehydrogenase (G6PD) deficiency is a common inherited enzymopathy in which the main clinical complication is hemolysis after ingestion of oxidant drugs (anti-malarials, sulfonamides, analgesics, nitrofurans) and consumption of fava beans.

As an illustrative embodiment, the activity of drug metabolizing enzymes is a major determinant of both the intensity and duration of drug action. The discovery of genetic polymorphisms of drug metabolizing enzymes (*e.g.*, N-acetyltransferase 2 (NAT 2) and cytochrome P450 enzymes CYP2D6 and CYP2C19) has provided an explanation as to why some patients do not obtain the expected drug effects or show exaggerated drug response and serious toxicity after taking the standard and safe dose of a drug. These polymorphisms are expressed in two phenotypes in the population, the extensive metabolizer (EM) and poor metabolizer (PM). The prevalence of PM is different among different populations. For example, the gene coding for CYP2D6 is highly polymorphic and several mutations have been identified in PM, which all lead to the absence of functional CYP2D6. Poor metabolizers of CYP2D6 and CYP2C19 quite frequently experience exaggerated drug response and side effects when they receive standard doses. If a metabolite is the active therapeutic moiety, PM show no therapeutic response, as demonstrated for the analgesic effect of codeine mediated by

its CYP2D6-formed metabolite morphine. At the other extreme are the so called ultra-rapid metabolizers who do not respond to standard doses. Recently, the molecular basis of ultra-rapid metabolism has been identified to be due to CYP2D6 gene amplification.

Thus, the activity of NOVX protein, expression of NOVX nucleic acid, or mutation content of NOVX genes in an individual can be determined to thereby select appropriate agent(s) for therapeutic or prophylactic treatment of the individual. In addition, pharmacogenetic studies can be used to apply genotyping of polymorphic alleles encoding drug-metabolizing enzymes to the identification of an individual's drug responsiveness phenotype. This knowledge, when applied to dosing or drug selection, can avoid adverse reactions or therapeutic failure and thus enhance therapeutic or prophylactic efficiency when treating a subject with an NOVX modulator, such as a modulator identified by one of the exemplary screening assays described herein.

### Monitoring of Effects During Clinical Trials

Monitoring the influence of agents (*e.g.*, drugs, compounds) on the expression or activity of NOVX (*e.g.*, the ability to modulate aberrant cell proliferation and/or differentiation) can be applied not only in basic drug screening, but also in clinical trials. For example, the effectiveness of an agent determined by a screening assay as described herein to increase NOVX gene expression, protein levels, or upregulate NOVX activity, can be monitored in clinical trails of subjects exhibiting decreased NOVX gene expression, protein levels, or downregulated NOVX activity. Alternatively, the effectiveness of an agent determined by a screening assay to decrease NOVX gene expression, protein levels, or downregulate NOVX activity, can be monitored in clinical trails of subjects exhibiting increased NOVX gene expression, protein levels, or upregulated NOVX activity. In such clinical trials, the expression or activity of NOVX and, preferably, other genes that have been implicated in, for example, a cellular proliferation or immune disorder can be used as a "read out" or markers of the immune responsiveness of a particular cell.

By way of example, and not of limitation, genes, including NOVX, that are modulated in cells by treatment with an agent (*e.g.*, compound, drug or small molecule) that modulates NOVX activity (*e.g.*, identified in a screening assay as described herein) can be identified. Thus, to study the effect of agents on cellular proliferation disorders, for example, in a clinical trial, cells can be isolated and RNA prepared and analyzed for the levels of expression of NOVX and other genes implicated in the disorder. The levels of gene expression (*i.e.*, a gene expression pattern) can be quantified by Northern blot analysis or RT-PCR, as described herein, or alternatively by measuring the amount of protein produced, by one of the methods

as described herein, or by measuring the levels of activity of NOVX or other genes. In this manner, the gene expression pattern can serve as a marker, indicative of the physiological response of the cells to the agent. Accordingly, this response state may be determined before, and at various points during, treatment of the individual with the agent.

5 In one embodiment, the invention provides a method for monitoring the effectiveness of treatment of a subject with an agent (*e.g.*, an agonist, antagonist, protein, peptide, peptidomimetic, nucleic acid, small molecule, or other drug candidate identified by the screening assays described herein) comprising the steps of (i) obtaining a pre-administration sample from a subject prior to administration of the agent; (ii) detecting the level of expression  
10 of an NOVX protein, mRNA, or genomic DNA in the preadministration sample; (iii) obtaining one or more post-administration samples from the subject; (iv) detecting the level of expression or activity of the NOVX protein, mRNA, or genomic DNA in the post-administration samples; (v) comparing the level of expression or activity of the NOVX protein, mRNA, or genomic DNA in the pre-administration sample with the NOVX protein,  
15 mRNA, or genomic DNA in the post administration sample or samples; and (vi) altering the administration of the agent to the subject accordingly. For example, increased administration of the agent may be desirable to increase the expression or activity of NOVX to higher levels than detected, *i.e.*, to increase the effectiveness of the agent. Alternatively, decreased administration of the agent may be desirable to decrease expression or activity of NOVX to  
20 lower levels than detected, *i.e.*, to decrease the effectiveness of the agent.

### Methods of Treatment

The invention provides for both prophylactic and therapeutic methods of treating a subject at risk of (or susceptible to) a disorder or having a disorder associated with aberrant NOVX expression or activity. The disorders include cardiomyopathy, atherosclerosis,  
25 hypertension, congenital heart defects, aortic stenosis, atrial septal defect (ASD), atrioventricular (A-V) canal defect, ductus arteriosus, pulmonary stenosis, subaortic stenosis, ventricular septal defect (VSD), valve diseases, tuberous sclerosis, scleroderma, obesity, transplantation, adrenoleukodystrophy, congenital adrenal hyperplasia, prostate cancer, neoplasm; adenocarcinoma, lymphoma, uterus cancer, fertility, hemophilia, hypercoagulation,  
30 idiopathic thrombocytopenic purpura, immunodeficiencies, graft versus host disease, AIDS, bronchial asthma, Crohn's disease; multiple sclerosis, treatment of Albright Hereditary Osteodystrophy, and other diseases, disorders and conditions of the like.

These methods of treatment will be discussed more fully, below.



## Disease and Disorders

Diseases and disorders that are characterized by increased (relative to a subject not suffering from the disease or disorder) levels or biological activity may be treated with Therapeutics that antagonize (*i.e.*, reduce or inhibit) activity. Therapeutics that antagonize activity may be administered in a therapeutic or prophylactic manner. Therapeutics that may be utilized include, but are not limited to: (i) an aforementioned peptide, or analogs, derivatives, fragments or homologs thereof; (ii) antibodies to an aforementioned peptide; (iii) nucleic acids encoding an aforementioned peptide; (iv) administration of antisense nucleic acid and nucleic acids that are "dysfunctional" (*i.e.*, due to a heterologous insertion within the coding sequences of coding sequences to an aforementioned peptide) that are utilized to "knockout" endogenous function of an aforementioned peptide by homologous recombination (*see, e.g.*, Capecchi, 1989. *Science* 244: 1288-1292); or (v) modulators (*i.e.*, inhibitors, agonists and antagonists, including additional peptide mimetic of the invention or antibodies specific to a peptide of the invention) that alter the interaction between an aforementioned peptide and its binding partner.

Diseases and disorders that are characterized by decreased (relative to a subject not suffering from the disease or disorder) levels or biological activity may be treated with Therapeutics that increase (*i.e.*, are agonists to) activity. Therapeutics that upregulate activity may be administered in a therapeutic or prophylactic manner. Therapeutics that may be utilized include, but are not limited to, an aforementioned peptide, or analogs, derivatives, fragments or homologs thereof; or an agonist that increases bioavailability.

Increased or decreased levels can be readily detected by quantifying peptide and/or RNA, by obtaining a patient tissue sample (*e.g.*, from biopsy tissue) and assaying it *in vitro* for RNA or peptide levels, structure and/or activity of the expressed peptides (or mRNAs of an aforementioned peptide). Methods that are well-known within the art include, but are not limited to, immunoassays (*e.g.*, by Western blot analysis, immunoprecipitation followed by sodium dodecyl sulfate (SDS) polyacrylamide gel electrophoresis, immunocytochemistry, etc.) and/or hybridization assays to detect expression of mRNAs (*e.g.*, Northern assays, dot blots, *in situ* hybridization, and the like).

## Prophylactic Methods

In one aspect, the invention provides a method for preventing, in a subject, a disease or condition associated with an aberrant NOVX expression or activity, by administering to the subject an agent that modulates NOVX expression or at least one NOVX activity. Subjects at

risk for a disease that is caused or contributed to by aberrant NOVX expression or activity can be identified by, for example, any or a combination of diagnostic or prognostic assays as described herein. Administration of a prophylactic agent can occur prior to the manifestation of symptoms characteristic of the NOVX aberrancy, such that a disease or disorder is prevented or, alternatively, delayed in its progression. Depending upon the type of NOVX aberrancy, for example, an NOVX agonist or NOVX antagonist agent can be used for treating the subject. The appropriate agent can be determined based on screening assays described herein. The prophylactic methods of the invention are further discussed in the following subsections.

## 10 Therapeutic Methods

Another aspect of the invention pertains to methods of modulating NOVX expression or activity for therapeutic purposes. The modulatory method of the invention involves contacting a cell with an agent that modulates one or more of the activities of NOVX protein activity associated with the cell. An agent that modulates NOVX protein activity can be an agent as described herein, such as a nucleic acid or a protein, a naturally-occurring cognate ligand of an NOVX protein, a peptide, an NOVX peptidomimetic, or other small molecule. In one embodiment, the agent stimulates one or more NOVX protein activity. Examples of such stimulatory agents include active NOVX protein and a nucleic acid molecule encoding NOVX that has been introduced into the cell. In another embodiment, the agent inhibits one or more NOVX protein activity. Examples of such inhibitory agents include antisense NOVX nucleic acid molecules and anti-NOVX antibodies. These modulatory methods can be performed *in vitro* (e.g., by culturing the cell with the agent) or, alternatively, *in vivo* (e.g., by administering the agent to a subject). As such, the invention provides methods of treating an individual afflicted with a disease or disorder characterized by aberrant expression or activity of an NOVX protein or nucleic acid molecule. In one embodiment, the method involves administering an agent (e.g., an agent identified by a screening assay described herein), or combination of agents that modulates (e.g., up-regulates or down-regulates) NOVX expression or activity. In another embodiment, the method involves administering an NOVX protein or nucleic acid molecule as therapy to compensate for reduced or aberrant NOVX expression or activity.

Stimulation of NOVX activity is desirable *in situations* in which NOVX is abnormally downregulated and/or in which increased NOVX activity is likely to have a beneficial effect. One example of such a situation is where a subject has a disorder characterized by aberrant

cell proliferation and/or differentiation (e.g., cancer or immune associated disorders). Another example of such a situation is where the subject has a gestational disease (e.g., preclampsia).

### **Determination of the Biological Effect of the Therapeutic**

5 In various embodiments of the invention, suitable *in vitro* or *in vivo* assays are performed to determine the effect of a specific Therapeutic and whether its administration is indicated for treatment of the affected tissue.

10 In various specific embodiments, *in vitro* assays may be performed with representative cells of the type(s) involved in the patient's disorder, to determine if a given Therapeutic exerts the desired effect upon the cell type(s). Compounds for use in therapy may be tested in suitable animal model systems including, but not limited to rats, mice, chicken, cows, monkeys, rabbits, and the like, prior to testing in human subjects. Similarly, for *in vivo* testing, any of the animal model system known in the art may be used prior to administration to human subjects.

### **Prophylactic and Therapeutic Uses of the Compositions of the Invention**

15 The NOVX nucleic acids and proteins of the invention are useful in potential prophylactic and therapeutic applications implicated in a variety of disorders including, but not limited to: metabolic disorders, diabetes, obesity, infectious disease, anorexia, cancer-associated cancer, neurodegenerative disorders, Alzheimer's Disease, Parkinson's Disorder, immune disorders, hematopoietic disorders, and the various dyslipidemias, metabolic  
20 disturbances associated with obesity, the metabolic syndrome X and wasting disorders associated with chronic diseases and various cancers.

As an example, a cDNA encoding the NOVX protein of the invention may be useful in gene therapy, and the protein may be useful when administered to a subject in need thereof. By way of non-limiting example, the compositions of the invention will have efficacy for  
25 treatment of patients suffering from: metabolic disorders, diabetes, obesity, infectious disease, anorexia, cancer-associated cachexia, cancer, neurodegenerative disorders, Alzheimer's Disease, Parkinson's Disorder, immune disorders, hematopoietic disorders, and the various dyslipidemias.

Both the novel nucleic acid encoding the NOVX protein, and the NOVX protein of the  
30 invention, or fragments thereof, may also be useful in diagnostic applications, wherein the presence or amount of the nucleic acid or the protein are to be assessed. A further use could be as an anti-bacterial molecule (i.e., some peptides have been found to possess anti-bacterial properties). These materials are further useful in the generation of antibodies, which

immunospecifically-bind to the novel substances of the invention for use in therapeutic or diagnostic methods.

The invention will be further described in the following examples, which do not limit the scope of the invention described in the claims.

5

## EXAMPLES

### Example 1. Identification of NOVX clones

10 The novel NOVX target sequences identified in the present invention were subjected to the exon linking process to confirm the sequence. PCR primers were designed by starting at the most upstream sequence available, for the forward primer, and at the most downstream  
15 sequence available for the reverse primer. Table 21A shows the sequences of the PCR primers used for obtaining different clones. In each case, the sequence was examined, walking inward from the respective termini toward the coding sequence, until a suitable sequence that is either unique or highly selective was encountered, or, in the case of the reverse primer, until the stop codon was reached. Such primers were designed based on in silico predictions for the full  
20 length cDNA, part (one or more exons) of the DNA or protein sequence of the target sequence, or by translated homology of the predicted exons to closely related human sequences from other species. These primers were then employed in PCR amplification based on the following pool of human cDNAs: adrenal gland, bone marrow, brain - amygdala, brain - cerebellum, brain - hippocampus, brain - substantia nigra, brain - thalamus, brain -whole,  
25 fetal brain, fetal kidney, fetal liver, fetal lung, heart, kidney, lymphoma - Raji, mammary gland, pancreas, pituitary gland, placenta, prostate, salivary gland, skeletal muscle, small intestine, spinal cord, spleen, stomach, testis, thyroid, trachea, uterus. Usually the resulting amplicons were gel purified, cloned and sequenced to high redundancy. The PCR product derived from exon linking was cloned into the pCR2.1 vector from Invitrogen. The resulting  
30 bacterial clone has an insert covering the entire open reading frame cloned into the pCR2.1 vector. The resulting sequences from all clones were assembled with themselves, with other fragments in CuraGen Corporation's database and with public ESTs. Fragments and ESTs were included as components for an assembly when the extent of their identity with another component of the assembly was at least 95% over 50 bp. In addition, sequence traces were evaluated manually and edited for corrections if appropriate. These procedures provide the sequence reported herein.

Table 21A. PCR Primers for Exon Linking

NOVX Clone	Primer 1 (5' - 3')	SEQ ID	Primer 2 (5' - 3')	SEQ ID
---------------	--------------------	-----------	--------------------	-----------

		NO		NO
3	GTAAATTGGAAGAGTTTGTTCAGGGAA	242	CTTGGAATCCATCTTTCATTAAGTGAGC	243
9	CTATCTGCCAATTTTCATTGTGGACAG	244	TTCGAATTAAGGTTCCAAGGCTATGAG	245
12b	CGGGAAGACTCGCCAGCAC	246	AAAGCCTTTTATGGGTCTTTGAATTTATTG	247
14b	TGCTGAGGGTGCATTTATGTTTCAG	248	CCACACGTGGATAATCAAGAGTTGAC	249
16b	GCGGCGGCCATGGGAGATA	250	AGGAAGGGGAAGCGTCCTCAGTATTC	251
16c	GCGGCGGCCATGGGAGATA	252	AGGAAGGGGAAGCGTCCTCAGTATTC	253
17	AGCACGCACTTGCCCAGAGCTATC	254	CCTATGGCTGAAGGCGGAGGT	255
18	CTGGGTCTCCCTCCAC	256	GTTTATTCTGAGCACCGGAA	257
20	AGGCCTGCAGGTGGGTGTC	258	CTGCAGGCTCCTACAGTACTGCC	259

## Example 2. Quantitative expression analysis of clones in various cells and tissues

The quantitative expression of various clones was assessed using microtiter plates containing RNA samples from a variety of normal and pathology-derived cells, cell lines and tissues using real time quantitative PCR (RTQ PCR). RTQ PCR was performed on an Applied Biosystems ABI PRISM® 7700 or an ABI PRISM® 7900 HT Sequence Detection System. Various collections of samples are assembled on the plates, and referred to as Panel 1 (containing normal tissues and cancer cell lines), Panel 2 (containing samples derived from tissues from normal and cancer sources), Panel 3 (containing cancer cell lines), Panel 4 (containing cells and cell lines from normal tissues and cells related to inflammatory conditions), Panel 5D/5I (containing human tissues and cell lines with an emphasis on metabolic diseases), AI\_comprehensive\_panel (containing normal tissue and samples from autoimmune diseases), Panel CNSD.01 (containing central nervous system samples from normal and diseased brains) and CNS\_neurodegeneration\_panel (containing samples from normal and Alzheimer's diseased brains).

RNA integrity from all samples is controlled for quality by visual assessment of agarose gel electropherograms using 28S and 18S ribosomal RNA staining intensity ratio as a guide (2:1 to 2.5:1 28s:18s) and the absence of low molecular weight RNAs that would be indicative of degradation products. Samples are controlled against genomic DNA contamination by RTQ PCR reactions run in the absence of reverse transcriptase using probe and primer sets designed to amplify across the span of a single exon.

First, the RNA samples were normalized to reference nucleic acids such as constitutively expressed genes (for example,  $\beta$ -actin and GAPDH). Normalized RNA (5  $\mu$ l) was converted to cDNA and analyzed by RTQ-PCR using One Step RT-PCR Master Mix Reagents (Applied Biosystems; Catalog No. 4309169) and gene-specific primers according to the manufacturer's instructions.

In other cases, non-normalized RNA samples were converted to single strand cDNA (sscDNA) using Superscript II (Invitrogen Corporation; Catalog No. 18064-147) and random

hexamers according to the manufacturer's instructions. Reactions containing up to 10 µg of total RNA were performed in a volume of 20 µl and incubated for 60 minutes at 42°C. This reaction can be scaled up to 50 µg of total RNA in a final volume of 100 µl. sscDNA samples are then normalized to reference nucleic acids as described previously, using 1X TaqMan® Universal Master mix (Applied Biosystems; catalog No. 4324020), following the manufacturer's instructions.

Probes and primers were designed for each assay according to Applied Biosystems Primer Express Software package (version I for Apple Computer's Macintosh Power PC) or a similar algorithm using the target sequence as input. Default settings were used for reaction conditions and the following parameters were set before selecting primers: primer concentration = 250 nM, primer melting temperature (T<sub>m</sub>) range = 58°-60°C, primer optimal T<sub>m</sub> = 59°C, maximum primer difference = 2°C, probe does not have 5'G, probe T<sub>m</sub> must be 10°C greater than primer T<sub>m</sub>, amplicon size 75bp to 100bp. The probes and primers selected (see below) were synthesized by Synthesgen (Houston, TX, USA). Probes were double purified by HPLC to remove uncoupled dye and evaluated by mass spectroscopy to verify coupling of reporter and quencher dyes to the 5' and 3' ends of the probe, respectively. Their final concentrations were: forward and reverse primers, 900nM each, and probe, 200nM.

PCR conditions: When working with RNA samples, normalized RNA from each tissue and each cell line was spotted in each well of either a 96 well or a 384-well PCR plate (Applied Biosystems). PCR cocktails included either a single gene specific probe and primers set, or two multiplexed probe and primers sets (a set specific for the target clone and another gene-specific set multiplexed with the target probe). PCR reactions were set up using TaqMan® One-Step RT-PCR Master Mix (Applied Biosystems, Catalog No. 4313803) following manufacturer's instructions. Reverse transcription was performed at 48°C for 30 minutes followed by amplification/PCR cycles as follows: 95°C 10 min, then 40 cycles of 95°C for 15 seconds, 60°C for 1 minute. Results were recorded as CT values (cycle at which a given sample crosses a threshold level of fluorescence) using a log scale, with the difference in RNA concentration between a given sample and the sample with the lowest CT value being represented as 2 to the power of delta CT. The percent relative expression is then obtained by taking the reciprocal of this RNA difference and multiplying by 100.

When working with sscDNA samples, normalized sscDNA was used as described previously for RNA samples. PCR reactions containing one or two sets of probe and primers were set up as described previously, using 1X TaqMan® Universal Master mix (Applied Biosystems; catalog No. 4324020), following the manufacturer's instructions. PCR

amplification was performed as follows: 95°C 10 min, then 40 cycles of 95°C for 15 seconds, 60°C for 1 minute. Results were analyzed and processed as described previously.

### **Panels 1, 1.1, 1.2, and 1.3D**

The plates for Panels 1, 1.1, 1.2 and 1.3D include 2 control wells (genomic DNA control and chemistry control) and 94 wells containing cDNA from various samples. The samples in these panels are broken into 2 classes: samples derived from cultured cell lines and samples derived from primary normal tissues. The cell lines are derived from cancers of the following types: lung cancer, breast cancer, melanoma, colon cancer, prostate cancer, CNS cancer, squamous cell carcinoma, ovarian cancer, liver cancer, renal cancer, gastric cancer and pancreatic cancer. Cell lines used in these panels are widely available through the American Type Culture Collection (ATCC), a repository for cultured cell lines, and were cultured using the conditions recommended by the ATCC. The normal tissues found on these panels are comprised of samples derived from all major organ systems from single adult individuals or fetuses. These samples are derived from the following organs: adult skeletal muscle, fetal skeletal muscle, adult heart, fetal heart, adult kidney, fetal kidney, adult liver, fetal liver, adult lung, fetal lung, various regions of the brain, the spleen, bone marrow, lymph node, pancreas, salivary gland, pituitary gland, adrenal gland, spinal cord, thymus, stomach, small intestine, colon, bladder, trachea, breast, ovary, uterus, placenta, prostate, testis and adipose.

In the results for Panels 1, 1.1, 1.2 and 1.3D, the following abbreviations are used:

ca. = carcinoma,  
\* = established from metastasis,  
met = metastasis,  
s cell var = small cell variant,  
non-s = non-sm = non-small,  
squamous = squamous,  
pl. eff = pl effusion = pleural effusion,  
glio = glioma,  
astro = astrocytoma, and  
neuro = neuroblastoma.

### **General\_screening\_panel\_v1.4**

The plates for Panel 1.4 include 2 control wells (genomic DNA control and chemistry control) and 94 wells containing cDNA from various samples. The samples in Panel 1.4 are broken into 2 classes: samples derived from cultured cell lines and samples derived from primary normal tissues. The cell lines are derived from cancers of the following types: lung cancer, breast cancer, melanoma, colon cancer, prostate cancer, CNS cancer, squamous cell carcinoma, ovarian cancer, liver cancer, renal cancer, gastric cancer and pancreatic cancer.

Cell lines used in Panel 1.4 are widely available through the American Type Culture Collection (ATCC), a repository for cultured cell lines, and were cultured using the conditions recommended by the ATCC. The normal tissues found on Panel 1.4 are comprised of pools of samples derived from all major organ systems from 2 to 5 different adult individuals or fetuses. These samples are derived from the following organs: adult skeletal muscle, fetal skeletal muscle, adult heart, fetal heart, adult kidney, fetal kidney, adult liver, fetal liver, adult lung, fetal lung, various regions of the brain, the spleen, bone marrow, lymph node, pancreas, salivary gland, pituitary gland, adrenal gland, spinal cord, thymus, stomach, small intestine, colon, bladder, trachea, breast, ovary, uterus, placenta, prostate, testis and adipose.

Abbreviations are as described for Panels 1, 1.1, 1.2, and 1.3D.

### **Panels 2D and 2.2**

The plates for Panels 2D and 2.2 generally include 2 control wells and 94 test samples composed of RNA or cDNA isolated from human tissue procured by surgeons working in close cooperation with the National Cancer Institute's Cooperative Human Tissue Network (CHTN) or the National Disease Research Initiative (NDRI). The tissues are derived from human malignancies and in cases where indicated many malignant tissues have "matched margins" obtained from noncancerous tissue just adjacent to the tumor. These are termed normal adjacent tissues and are denoted "NAT" in the results below. The tumor tissue and the "matched margins" are evaluated by two independent pathologists (the surgical pathologists and again by a pathologist at NDRI or CHTN). This analysis provides a gross histopathological assessment of tumor differentiation grade. Moreover, most samples include the original surgical pathology report that provides information regarding the clinical stage of the patient. These matched margins are taken from the tissue surrounding (i.e. immediately proximal) to the zone of surgery (designated "NAT", for normal adjacent tissue, in Table RR).

In addition, RNA and cDNA samples were obtained from various human tissues derived from autopsies performed on elderly people or sudden death victims (accidents, etc.). These tissues were ascertained to be free of disease and were purchased from various commercial sources such as Clontech (Palo Alto, CA), Research Genetics, and Invitrogen.

### **Panel 3D**

The plates of Panel 3D are comprised of 94 cDNA samples and two control samples. Specifically, 92 of these samples are derived from cultured human cancer cell lines, 2 samples of human primary cerebellar tissue and 2 controls. The human cell lines are generally obtained from ATCC (American Type Culture Collection), NCI or the German tumor cell bank and fall



into the following tissue groups: Squamous cell carcinoma of the tongue, breast cancer, prostate cancer, melanoma, epidermoid carcinoma, sarcomas, bladder carcinomas, pancreatic cancers, kidney cancers, leukemias/lymphomas, ovarian/uterine/cervical, gastric, colon, lung and CNS cancer cell lines. In addition, there are two independent samples of cerebellum.

- 5 These cells are all cultured under standard recommended conditions and RNA extracted using the standard procedures. The cell lines in panel 3D and 1.3D are of the most common cell lines used in the scientific literature.

#### **Panels 4D, 4R, and 4.1D**

- Panel 4 includes samples on a 96 well plate (2 control wells, 94 test samples)  
10 composed of RNA (Panel 4R) or cDNA (Panels 4D/4.1D) isolated from various human cell lines or tissues related to inflammatory conditions. Total RNA from control normal tissues such as colon and lung (Stratagene, La Jolla, CA) and thymus and kidney (Clontech) was employed. Total RNA from liver tissue from cirrhosis patients and kidney from lupus patients was obtained from BioChain (Biochain Institute, Inc., Hayward, CA). Intestinal tissue for  
15 RNA preparation from patients diagnosed as having Crohn's disease and ulcerative colitis was obtained from the National Disease Research Interchange (NDRI) (Philadelphia, PA).

- Astrocytes, lung fibroblasts, dermal fibroblasts, coronary artery smooth muscle cells, small airway epithelium, bronchial epithelium, microvascular dermal endothelial cells, microvascular lung endothelial cells, human pulmonary aortic endothelial cells, human  
20 umbilical vein endothelial cells were all purchased from Clonetics (Walkersville, MD) and grown in the media supplied for these cell types by Clonetics. These primary cell types were activated with various cytokines or combinations of cytokines for 6 and/or 12-14 hours, as indicated. The following cytokines were used; IL-1 beta at approximately 1-5ng/ml, TNF alpha at approximately 5-10ng/ml, IFN gamma at approximately 20-50ng/ml, IL-4 at  
25 approximately 5-10ng/ml, IL-9 at approximately 5-10ng/ml, IL-13 at approximately 5-10ng/ml. Endothelial cells were sometimes starved for various times by culture in the basal media from Clonetics with 0.1% serum.

- Mononuclear cells were prepared from blood of employees at CuraGen Corporation, using Ficoll. LAK cells were prepared from these cells by culture in DMEM 5% FCS  
30 (Hyclone), 100µM non essential amino acids (Gibco/Life Technologies, Rockville, MD), 1mM sodium pyruvate (Gibco), mercaptoethanol  $5.5 \times 10^{-5}$  M (Gibco), and 10mM Hepes (Gibco) and Interleukin 2 for 4-6 days. Cells were then either activated with 10-20ng/ml PMA and 1-2µg/ml ionomycin, IL-12 at 5-10ng/ml, IFN gamma at 20-50ng/ml and IL-18 at 5-

10ng/ml for 6 hours. In some cases, mononuclear cells were cultured for 4-5 days in DMEM 5% FCS (Hyclone), 100µM non essential amino acids (Gibco), 1mM sodium pyruvate (Gibco), mercaptoethanol  $5.5 \times 10^{-5}$ M (Gibco), and 10mM Hepes (Gibco) with PHA (phytohemagglutinin) or PWM (pokeweed mitogen) at approximately 5µg/ml. Samples were taken at 24, 48 and 72 hours for RNA preparation. MLR (mixed lymphocyte reaction) samples were obtained by taking blood from two donors, isolating the mononuclear cells using Ficoll and mixing the isolated mononuclear cells 1:1 at a final concentration of approximately  $2 \times 10^6$  cells/ml in DMEM 5% FCS (Hyclone), 100µM non essential amino acids (Gibco), 1mM sodium pyruvate (Gibco), mercaptoethanol ( $5.5 \times 10^{-5}$ M) (Gibco), and 10mM Hepes (Gibco). The MLR was cultured and samples taken at various time points ranging from 1- 7 days for RNA preparation.

Monocytes were isolated from mononuclear cells using CD14 Miltenyi Beads, +ve VS selection columns and a Vario Magnet according to the manufacturer's instructions. Monocytes were differentiated into dendritic cells by culture in DMEM 5% fetal calf serum (FCS) (Hyclone, Logan, UT), 100µM non essential amino acids (Gibco), 1mM sodium pyruvate (Gibco), mercaptoethanol  $5.5 \times 10^{-5}$ M (Gibco), and 10mM Hepes (Gibco), 50ng/ml GMCSF and 5ng/ml IL-4 for 5-7 days. Macrophages were prepared by culture of monocytes for 5-7 days in DMEM 5% FCS (Hyclone), 100µM non essential amino acids (Gibco), 1mM sodium pyruvate (Gibco), mercaptoethanol  $5.5 \times 10^{-5}$ M (Gibco), 10mM Hepes (Gibco) and 10% AB Human Serum or MCSF at approximately 50ng/ml. Monocytes, macrophages and dendritic cells were stimulated for 6 and 12-14 hours with lipopolysaccharide (LPS) at 100ng/ml. Dendritic cells were also stimulated with anti-CD40 monoclonal antibody (Pharmingen) at 10µg/ml for 6 and 12-14 hours.

CD4 lymphocytes, CD8 lymphocytes and NK cells were also isolated from mononuclear cells using CD4, CD8 and CD56 Miltenyi beads, positive VS selection columns and a Vario Magnet according to the manufacturer's instructions. CD45RA and CD45RO CD4 lymphocytes were isolated by depleting mononuclear cells of CD8, CD56, CD14 and CD19 cells using CD8, CD56, CD14 and CD19 Miltenyi beads and positive selection. CD45RO beads were then used to isolate the CD45RO CD4 lymphocytes with the remaining cells being CD45RA CD4 lymphocytes. CD45RA CD4, CD45RO CD4 and CD8 lymphocytes were placed in DMEM 5% FCS (Hyclone), 100µM non essential amino acids (Gibco), 1mM sodium pyruvate (Gibco), mercaptoethanol  $5.5 \times 10^{-5}$ M (Gibco), and 10mM Hepes (Gibco) and plated at  $10^6$  cells/ml onto Falcon 6 well tissue culture plates that had been coated overnight with 0.5µg/ml anti-CD28 (Pharmingen) and 3ug/ml anti-CD3 (OKT3, ATCC) in PBS. After 6

and 24 hours, the cells were harvested for RNA preparation. To prepare chronically activated CD8 lymphocytes, we activated the isolated CD8 lymphocytes for 4 days on anti-CD28 and anti-CD3 coated plates and then harvested the cells and expanded them in DMEM 5% FCS (Hyclone), 100 $\mu$ M non essential amino acids (Gibco), 1mM sodium pyruvate (Gibco), mercaptoethanol 5.5x10<sup>-5</sup>M (Gibco), and 10mM Hepes (Gibco) and IL-2. The expanded CD8 cells were then activated again with plate bound anti-CD3 and anti-CD28 for 4 days and expanded as before. RNA was isolated 6 and 24 hours after the second activation and after 4 days of the second expansion culture. The isolated NK cells were cultured in DMEM 5% FCS (Hyclone), 100 $\mu$ M non essential amino acids (Gibco), 1mM sodium pyruvate (Gibco), mercaptoethanol 5.5x10<sup>-5</sup>M (Gibco), and 10mM Hepes (Gibco) and IL-2 for 4-6 days before RNA was prepared.

To obtain B cells, tonsils were procured from NDRI. The tonsil was cut up with sterile dissecting scissors and then passed through a sieve. Tonsil cells were then spun down and resuspended at 10<sup>6</sup>cells/ml in DMEM 5% FCS (Hyclone), 100 $\mu$ M non essential amino acids (Gibco), 1mM sodium pyruvate (Gibco), mercaptoethanol 5.5x10<sup>-5</sup>M (Gibco), and 10mM Hepes (Gibco). To activate the cells, we used PWM at 5 $\mu$ g/ml or anti-CD40 (Pharmingen) at approximately 10 $\mu$ g/ml and IL-4 at 5-10ng/ml. Cells were harvested for RNA preparation at 24,48 and 72 hours.

To prepare the primary and secondary Th1/Th2 and Tr1 cells, six-well Falcon plates were coated overnight with 10 $\mu$ g/ml anti-CD28 (Pharmingen) and 2 $\mu$ g/ml OKT3 (ATCC), and then washed twice with PBS. Umbilical cord blood CD4 lymphocytes (Poietic Systems, German Town, MD) were cultured at 10<sup>5</sup>-10<sup>6</sup>cells/ml in DMEM 5% FCS (Hyclone), 100 $\mu$ M non essential amino acids (Gibco), 1mM sodium pyruvate (Gibco), mercaptoethanol 5.5x10<sup>-5</sup>M (Gibco), 10mM Hepes (Gibco) and IL-2 (4ng/ml). IL-12 (5ng/ml) and anti-IL4 (1 $\mu$ g/ml) were used to direct to Th1, while IL-4 (5ng/ml) and anti-IFN gamma (1 $\mu$ g/ml) were used to direct to Th2 and IL-10 at 5ng/ml was used to direct to Tr1. After 4-5 days, the activated Th1, Th2 and Tr1 lymphocytes were washed once in DMEM and expanded for 4-7 days in DMEM 5% FCS (Hyclone), 100 $\mu$ M non essential amino acids (Gibco), 1mM sodium pyruvate (Gibco), mercaptoethanol 5.5x10<sup>-5</sup>M (Gibco), 10mM Hepes (Gibco) and IL-2 (1ng/ml). Following this, the activated Th1, Th2 and Tr1 lymphocytes were re-stimulated for 5 days with anti-CD28/OKT3 and cytokines as described above, but with the addition of anti-CD95L (1 $\mu$ g/ml) to prevent apoptosis. After 4-5 days, the Th1, Th2 and Tr1 lymphocytes were washed and then expanded again with IL-2 for 4-7 days. Activated Th1 and Th2 lymphocytes were maintained in this way for a maximum of three cycles. RNA was prepared from primary

and secondary Th1, Th2 and Tr1 after 6 and 24 hours following the second and third activations with plate bound anti-CD3 and anti-CD28 mAbs and 4 days into the second and third expansion cultures in Interleukin 2.

The following leukocyte cells lines were obtained from the ATCC: Ramos, EOL-1, KU-812. EOL cells were further differentiated by culture in 0.1mM dbcAMP at  $5 \times 10^5$  cells/ml for 8 days, changing the media every 3 days and adjusting the cell concentration to  $5 \times 10^5$  cells/ml. For the culture of these cells, we used DMEM or RPMI (as recommended by the ATCC), with the addition of 5% FCS (Hyclone), 100 $\mu$ M non essential amino acids (Gibco), 1mM sodium pyruvate (Gibco), mercaptoethanol  $5.5 \times 10^{-5}$  M (Gibco), 10mM Hepes (Gibco). RNA was either prepared from resting cells or cells activated with PMA at 10ng/ml and ionomycin at 1 $\mu$ g/ml for 6 and 14 hours. Keratinocyte line CCD106 and an airway epithelial tumor line NCI-H292 were also obtained from the ATCC. Both were cultured in DMEM 5% FCS (Hyclone), 100 $\mu$ M non essential amino acids (Gibco), 1mM sodium pyruvate (Gibco), mercaptoethanol  $5.5 \times 10^{-5}$  M (Gibco), and 10mM Hepes (Gibco). CCD1106 cells were activated for 6 and 14 hours with approximately 5 ng/ml TNF alpha and 1ng/ml IL-1 beta, while NCI-H292 cells were activated for 6 and 14 hours with the following cytokines: 5ng/ml IL-4, 5ng/ml IL-9, 5ng/ml IL-13 and 25ng/ml IFN gamma.

For these cell lines and blood cells, RNA was prepared by lysing approximately  $10^7$  cells/ml using Trizol (Gibco BRL). Briefly, 1/10 volume of bromochloropropane (Molecular Research Corporation) was added to the RNA sample, vortexed and after 10 minutes at room temperature, the tubes were spun at 14,000 rpm in a Sorvall SS34 rotor. The aqueous phase was removed and placed in a 15ml Falcon Tube. An equal volume of isopropanol was added and left at -20°C overnight. The precipitated RNA was spun down at 9,000 rpm for 15 min in a Sorvall SS34 rotor and washed in 70% ethanol. The pellet was redissolved in 300 $\mu$ l of RNase-free water and 35 $\mu$ l buffer (Promega) 5 $\mu$ l DTT, 7 $\mu$ l RNasin and 8 $\mu$ l DNase were added. The tube was incubated at 37°C for 30 minutes to remove contaminating genomic DNA, extracted once with phenol chloroform and re-precipitated with 1/10 volume of 3M sodium acetate and 2 volumes of 100% ethanol. The RNA was spun down and placed in RNase free water. RNA was stored at -80°C.

### 30 AI\_comprehensive panel\_v1.0

The plates for AI\_comprehensive panel\_v1.0 include two control wells and 89 test samples comprised of cDNA isolated from surgical and postmortem human tissues obtained from the Backus Hospital and Clinomics (Frederick, MD). Total RNA was extracted from

tissue samples from the Backus Hospital in the Facility at CuraGen. Total RNA from other tissues was obtained from Clinomics.

Joint tissues including synovial fluid, synovium, bone and cartilage were obtained from patients undergoing total knee or hip replacement surgery at the Backus Hospital. Tissue samples were immediately snap frozen in liquid nitrogen to ensure that isolated RNA was of optimal quality and not degraded. Additional samples of osteoarthritis and rheumatoid arthritis joint tissues were obtained from Clinomics. Normal control tissues were supplied by Clinomics and were obtained during autopsy of trauma victims.

Surgical specimens of psoriatic tissues and adjacent matched tissues were provided as total RNA by Clinomics. Two male and two female patients were selected between the ages of 25 and 47. None of the patients were taking prescription drugs at the time samples were isolated.

Surgical specimens of diseased colon from patients with ulcerative colitis and Crohn's disease and adjacent matched tissues were obtained from Clinomics. Bowel tissue from three female and three male Crohn's patients between the ages of 41-69 were used. Two patients were not on prescription medication while the others were taking dexamethasone, phenobarbital, or tylenol. Ulcerative colitis tissue was from three male and four female patients. Four of the patients were taking lebid and two were on phenobarbital.

Total RNA from post mortem lung tissue from trauma victims with no disease or with emphysema, asthma or COPD was purchased from Clinomics. Emphysema patients ranged in age from 40-70 and all were smokers, this age range was chosen to focus on patients with cigarette-linked emphysema and to avoid those patients with alpha-1 anti-trypsin deficiencies. Asthma patients ranged in age from 36-75, and excluded smokers to prevent those patients that could also have COPD. COPD patients ranged in age from 35-80 and included both smokers and non-smokers. Most patients were taking corticosteroids, and bronchodilators.

In the labels employed to identify tissues in the AI\_comprehensive panel\_v1.0 panel, the following abbreviations are used:

AI = Autoimmunity  
Syn = Synovial  
Normal = No apparent disease  
Rep22 /Rep20 = individual patients  
RA = Rheumatoid arthritis  
Backus = From Backus Hospital  
OA = Osteoarthritis  
(SS) (BA) (MF) = Individual patients  
Adj = Adjacent tissue

Match control = adjacent tissues  
-M = Male  
-F = Female  
COPD = Chronic obstructive pulmonary disease

5       **Panels 5D and 5I**

10       The plates for Panel 5D and 5I include two control wells and a variety of cDNAs isolated from human tissues and cell lines with an emphasis on metabolic diseases. Metabolic tissues were obtained from patients enrolled in the Gestational Diabetes study. Cells were obtained during different stages in the differentiation of adipocytes from human mesenchymal stem cells. Human pancreatic islets were also obtained.

      In the Gestational Diabetes study subjects are young (18 - 40 years), otherwise healthy women with and without gestational diabetes undergoing routine (elective) Caesarean section. After delivery of the infant, when the surgical incisions were being repaired/closed, the obstetrician removed a small sample.

15       Patient 2: Diabetic Hispanic, overweight, not on insulin  
      Patient 7-9: Nondiabetic Caucasian and obese (BMI>30)  
      Patient 10: Diabetic Hispanic, overweight, on insulin  
      Patient 11: Nondiabetic African American and overweight  
      Patient 12: Diabetic Hispanic on insulin

20       Adipocyte differentiation was induced in donor progenitor cells obtained from Osirus (a division of Clonetics/BioWhittaker) in triplicate, except for Donor 3U which had only two replicates. Scientists at Clonetics isolated, grew and differentiated human mesenchymal stem cells (HuMSCs) for CuraGen based on the published protocol found in Mark F. Pittenger, et al., Multilineage Potential of Adult Human Mesenchymal Stem Cells Science Apr 2 1999:  
25       143-147. Clonetics provided Trizol lysates or frozen pellets suitable for mRNA isolation and ds cDNA production. A general description of each donor is as follows:

      Donor 2 and 3 U: Mesenchymal Stem cells, Undifferentiated Adipose  
      Donor 2 and 3 AM: Adipose, AdiposeMidway Differentiated  
      Donor 2 and 3 AD: Adipose, Adipose Differentiated

30       Human cell lines were generally obtained from ATCC (American Type Culture Collection), NCI or the German tumor cell bank and fall into the following tissue groups: kidney proximal convoluted tubule, uterine smooth muscle cells, small intestine, liver HepG2 cancer cells, heart primary stromal cells, and adrenal cortical adenoma cells. These cells are all cultured under standard recommended conditions and RNA extracted using the standard  
35       procedures. All samples were processed at CuraGen to produce single stranded cDNA.

Panel 5I contains all samples previously described with the addition of pancreatic islets from a 58 year old female patient obtained from the Diabetes Research Institute at the University of Miami School of Medicine. Islet tissue was processed to total RNA at an outside source and delivered to CuraGen for addition to panel 5I.

5 In the labels employed to identify tissues in the 5D and 5I panels, the following abbreviations are used:

GO Adipose = Greater Omentum Adipose  
SK = Skeletal Muscle  
UT = Uterus  
10 PL = Placenta  
AD = Adipose Differentiated  
AM = Adipose Midway Differentiated  
U = Undifferentiated Stem Cells

**Panel CNSD.01**

15 The plates for Panel CNSD.01 include two control wells and 94 test samples comprised of cDNA isolated from postmortem human brain tissue obtained from the Harvard Brain Tissue Resource Center. Brains are removed from calvaria of donors between 4 and 24 hours after death, sectioned by neuroanatomists, and frozen at -80°C in liquid nitrogen vapor. All brains are sectioned and examined by neuropathologists to confirm diagnoses with clear  
20 associated neuropathology.

Disease diagnoses are taken from patient records. The panel contains two brains from each of the following diagnoses: Alzheimer's disease, Parkinson's disease, Huntington's disease, Progressive Supranuclear Palsy, Depression, and "Normal controls". Within each of these brains, the following regions are represented: cingulate gyrus, temporal pole, globus  
25 pallidus, substantia nigra, Brodman Area 4 (primary motor strip), Brodman Area 7 (parietal cortex), Brodman Area 9 (prefrontal cortex), and Brodman area 17 (occipital cortex). Not all brain regions are represented in all cases; e.g., Huntington's disease is characterized in part by neurodegeneration in the globus pallidus, thus this region is impossible to obtain from confirmed Huntington's cases. Likewise Parkinson's disease is characterized by degeneration  
30 of the substantia nigra making this region more difficult to obtain. Normal control brains were examined for neuropathology and found to be free of any pathology consistent with neurodegeneration.

In the labels employed to identify tissues in the CNS panel, the following abbreviations are used:

PSP = Progressive supranuclear palsy  
Sub Nigra = Substantia nigra  
Glob Palladus= Globus palladus  
Temp Pole = Temporal pole  
Cing Gyr = Cingulate gyrus  
BA 4 = Brodman Area 4

#### **Panel CNS\_Neurodegeneration\_V1.0**

The plates for Panel CNS\_Neurodegeneration\_V1.0 include two control wells and 47 test samples comprised of cDNA isolated from postmortem human brain tissue obtained from the Harvard Brain Tissue Resource Center (McLean Hospital) and the Human Brain and Spinal Fluid Resource Center (VA Greater Los Angeles Healthcare System). Brains are removed from calvaria of donors between 4 and 24 hours after death, sectioned by neuroanatomists, and frozen at -80°C in liquid nitrogen vapor. All brains are sectioned and examined by neuropathologists to confirm diagnoses with clear associated neuropathology.

Disease diagnoses are taken from patient records. The panel contains six brains from Alzheimer's disease (AD) patients, and eight brains from "Normal controls" who showed no evidence of dementia prior to death. The eight normal control brains are divided into two categories: Controls with no dementia and no Alzheimer's like pathology (Controls) and controls with no dementia but evidence of severe Alzheimer's like pathology, (specifically senile plaque load rated as level 3 on a scale of 0-3; 0 = no evidence of plaques, 3 = severe AD senile plaque load). Within each of these brains, the following regions are represented: hippocampus, temporal cortex (Brodman Area 21), parietal cortex (Brodman area 7), and occipital cortex (Brodman area 17). These regions were chosen to encompass all levels of neurodegeneration in AD. The hippocampus is a region of early and severe neuronal loss in AD; the temporal cortex is known to show neurodegeneration in AD after the hippocampus; the parietal cortex shows moderate neuronal death in the late stages of the disease; the occipital cortex is spared in AD and therefore acts as a "control" region within AD patients. Not all brain regions are represented in all cases.

In the labels employed to identify tissues in the CNS\_Neurodegeneration\_V1.0 panel, the following abbreviations are used:

AD = Alzheimer's disease brain; patient was demented and showed AD-like pathology upon autopsy  
Control = Control brains; patient not demented, showing no neuropathology  
Control (Path) = Control brains; pateint not demented but showing sever AD-like pathology  
SupTemporal Ctx = Superior Temporal Cortex  
Inf Temporal Ctx = Inferior Temporal Cortex



#### A. sggc\_draft\_ba186014\_20000730\_da1: LYSOSOMAL ACID LIPASE (NOV1)

Expression of gene sggc\_draft\_ba186014\_20000730\_da1 was assessed using the primer-probe sets Ag1456, Ag2446, Ag2132, Ag2444, Ag1899 and Ag2059, described in Tables AA, AB, AC, AD, AE and AF. Results of the RTQ-PCR runs are shown in Tables AG, AH, AI, AJ and AK.

Table AA. Probe Name Ag1456

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-tcctgaggtgtggatgaatact-3'	91	260
Probe	TET-5'-catcatctacaatggctaccccagtga-3'-TAMRA	121	261
Reverse	5'-ccatcttcagtggtgacttcac-3'	153	262

Table AB. Probe Name Ag2446

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-gaaacagtcggggaaacact-3'	354	263
Probe	TET-5'-tggtcaagaagacacaaaacactctca-3'-TAMRA	374	264
Reverse	5'-aaaccaaaggcccagaattt-3'	413	265

Table AC. Probe Name Ag2132

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-ggggaaatgacgctgataatat-3'	858	266
Probe	TET-5'-cccctatatatgacctgactgccatg-3'-TAMRA	903	267
Reverse	5'-cccaaatagcagtaggcacttt-3'	929	268

Table AD. Probe Name Ag2444

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-gaaacagtcggggaaacact-3'	354	269
Probe	TET-5'-tggtcaagaagacacaaaacactctca-3'-TAMRA	374	270
Reverse	5'-aaaccaaaggcccagaattt-3'	413	271

Table AE. Probe Name Ag1899

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-tcctgaggtgtggatgaatact-3'	91	272
Probe	TET-5'-catcatctacaatggctaccccagtga-3'-TAMRA	121	273
Reverse	5'-ccatcttcagtggtgacttcac-3'	153	274

Table AF. Probe Name Ag2059

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-ggggaaatgacgctgataatat-3'	858	275
Probe	TET-5'-cccctatatatgacctgactgccatg-3'-TAMRA	903	276
Reverse	5'-cccaaatagcagtaggcacttt-3'	929	277

Table AG. AI\_comprehensive panel\_v1.0

<b>Tissue Name</b>	<b>Rel. Exp.(%) Ag1456, Run 224501612</b>	<b>Tissue Name</b>	<b>Rel. Exp.(%) Ag1456, Run 224501612</b>
110967 COPD-F	0.0	112427 Match Control Psoriasis-F	0.0
110980 COPD-F	2.1	112418 Psoriasis-M	0.0
110968 COPD-M	0.0	112723 Match Control Psoriasis-M	0.0
110977 COPD-M	0.0	112419 Psoriasis-M	0.0
110989 Emphysema- F	2.6	112424 Match Control Psoriasis-M	0.0
110992 Emphysema- F	0.0	112420 Psoriasis-M	4.4
110993 Emphysema- F	0.0	112425 Match Control Psoriasis-M	0.0
110994 Emphysema- F	0.0	104689 (MF) OA Bone-Backus	0.0
110995 Emphysema- F	0.0	104690 (MF) Adj "Normal" Bone-Backus	3.0
110996 Emphysema- F	0.0	104691 (MF) OA Synovium-Backus	35.1
110997 Asthma-M	5.0	104692 (BA) OA Cartilage-Backus	0.0
111001 Asthma-F	1.6	104694 (BA) OA Bone-Backus	3.2
111002 Asthma-F	2.5	104695 (BA) Adj "Normal" Bone-Backus	3.1
111003 Atopic Asthma-F	0.0	104696 (BA) OA Synovium-Backus	20.9
111004 Atopic Asthma-F	0.0	104700 (SS) OA Bone- Backus	39.0
111005 Atopic Asthma-F	0.0	104701 (SS) Adj "Normal" Bone-Backus	3.3
111006 Atopic Asthma-F	0.0	104702 (SS) OA Synovium-Backus	5.0
111417 Allergy-M	0.0	117093 OA Cartilage Rep7	0.0
112347 Allergy-M	0.8	112672 OA Bone5	0.0
112349 Normal Lung- F	0.0	112673 OA Synovium5	0.0
112357 Normal Lung- F	0.0	112674 OA Synovial Fluid cells5	0.0
112354 Normal Lung- M	0.0	117100 OA Cartilage Rep14	0.0
112374 Crohns-F	2.4	112756 OA Bone9	0.0
112389 Match	100.0	112757 OA Synovium9	0.0

Control Crohns-F			
112375 Crohns-F	0.0	112758 OA Synovial Fluid Cells9	1.3
112732 Match Control Crohns-F	5.0	117125 RA Cartilage Rep2	0.0
112725 Crohns-M	1.5	113492 Bone2 RA	62.0
112387 Match Control Crohns-M	0.0	113493 Synovium2 RA	8.7
112378 Crohns-M	0.0	113494 Syn Fluid Cells RA	21.0
112390 Match Control Crohns-M	2.3	113499 Cartilage4 RA	20.6
112726 Crohns-M	0.0	113500 Bone4 RA	25.5
112731 Match Control Crohns-M	0.0	113501 Synovium4 RA	15.3
112380 Ulcer Col-F	0.0	113502 Syn Fluid Cells4 RA	8.5
112734 Match Control Ulcer Col-F	52.5	113495 Cartilage3 RA	33.7
112384 Ulcer Col-F	0.0	113496 Bone3 RA	33.7
112737 Match Control Ulcer Col-F	2.5	113497 Synovium3 RA	19.9
112386 Ulcer Col-F	2.4	113498 Syn Fluid Cells3 RA	37.6
112738 Match Control Ulcer Col-F	3.3	117106 Normal Cartilage Rep20	0.0
112381 Ulcer Col-M	0.0	113663 Bone3 Normal	0.0
112735 Match Control Ulcer Col-M	1.4	113664 Synovium3 Normal	0.9
112382 Ulcer Col-M	28.5	113665 Syn Fluid Cells3 Normal	0.0
112394 Match Control Ulcer Col-M	0.0	117107 Normal Cartilage Rep22	2.4
112383 Ulcer Col-M	0.0	113667 Bone4 Normal	0.0
112736 Match Control Ulcer Col-M	74.2	113668 Synovium4 Normal	0.0
112423 Psoriasis-F	4.4	113669 Syn Fluid Cells4 Normal	0.0

Table AH. Panel 1.2

Tissue Name	Rel. Exp.(%) Ag1456, Run 138374123	Tissue Name	Rel. Exp.(%) Ag1456, Run 138374123
Endothelial cells	0.0	Renal ca. 786-0	0.0
Heart (Fetal)	0.6	Renal ca. A498	0.0
Pancreas	0.0	Renal ca. RXF 393	0.0

Pancreatic ca. CAPAN 2	0.0	Renal ca. ACHN	0.0
Adrenal Gland	10.7	Renal ca. UO-31	0.0
Thyroid	1.3	Renal ca. TK-10	0.0
Salivary gland	3.2	Liver	4.1
Pituitary gland	0.3	Liver (fetal)	4.5
Brain (fetal)	0.6	Liver ca. (hepatoblast) HepG2	0.0
Brain (whole)	0.0	Lung	5.6
Brain (amygdala)	0.5	Lung (fetal)	1.2
Brain (cerebellum)	0.0	Lung ca. (small cell) LX-1	5.9
Brain (hippocampus)	0.7	Lung ca. (small cell) NCI-H69	1.7
Brain (thalamus)	0.7	Lung ca. (s.cell var.) SHP-77	0.0
Cerebral Cortex	0.0	Lung ca. (large cell) NCI-H460	0.0
Spinal cord	2.1	Lung ca. (non-sm. cell) A549	0.0
glio/astro U87-MG	0.0	Lung ca. (non-s.cell) NCI-H23	60.3
glio/astro U-118-MG	1.8	Lung ca. (non-s.cell) HOP-62	0.0
astrocytoma SW1783	0.0	Lung ca. (non-s.cl) NCI-H522	2.8
neuro*; met SK-N-AS	0.0	Lung ca. (squam.) SW 900	0.0
astrocytoma SF-539	0.0	Lung ca. (squam.) NCI-H596	0.0
astrocytoma SNB-75	0.0	Mammary gland	0.0
glioma SNB-19	0.0	Breast ca.* (pl.ef) MCF-7	0.9
glioma U251	0.0	Breast ca.* (pl.ef) MDA-MB-231	0.0
glioma SF-295	0.0	Breast ca.* (pl. ef) T47D	0.0
Heart	19.9	Breast ca. BT-549	0.0
Skeletal Muscle	8.2	Breast ca. MDA-N	0.0
Bone marrow	100.0	Ovary	0.0
Thymus	0.6	Ovarian ca. OVCAR-3	0.0
Spleen	12.3	Ovarian ca. OVCAR-4	0.0
Lymph node	0.9	Ovarian ca. OVCAR-	1.4

		5	
Colorectal Tissue	1.9	Ovarian ca. OVCAR-8	0.0
Stomach	2.0	Ovarian ca. IGROV-1	0.0
Small intestine	1.2	Ovarian ca. (ascites) SK-OV-3	0.0
Colon ca. SW480	0.5	Uterus	0.4
Colon ca.* SW620 (SW480 met)	3.1	Placenta	2.2
Colon ca. HT29	0.0	Prostate	1.4
Colon ca. HCT-116	0.0	Prostate ca.* (bone met) PC-3	0.0
Colon ca. CaCo-2	0.5	Testis	0.0
Colon ca. Tissue (ODO3866)	8.2	Melanoma Hs688(A).T	0.0
Colon ca. HCC-2998	0.0	Melanoma* (met) Hs688(B).T	0.0
Gastric ca.* (liver met) NCI-N87	2.4	Melanoma UACC-62	0.0
Bladder	29.1	Melanoma M14	0.0
Trachea	0.6	Melanoma LOX IMVI	0.0
Kidney	3.1	Melanoma* (met) SK-MEL-5	1.2
Kidney (fetal)	2.5		

Table AI. Panel 1.3D

Tissue Name	Rel. Exp.(%) Ag1456, Run 147644869	Rel. Exp.(%) Ag1456, Run 165529464	Rel. Exp.(%) Ag2132, Run 160164823	Rel. Exp.(%) Ag2444, Run 165629988
Liver adenocarcinoma	0.0	0.0	0.0	0.0
Pancreas	0.0	0.0	0.0	1.9
Pancreatic ca. CAPAN 2	0.0	0.0	0.0	0.0
Adrenal gland	9.2	7.6	5.2	1.9
Thyroid	0.0	0.0	0.0	1.6
Salivary gland	0.0	0.0	0.0	0.4
Pituitary gland	0.0	0.0	0.0	0.6
Brain (fetal)	0.0	0.0	0.0	1.4
Brain (whole)	0.0	0.0	0.0	0.3
Brain (amygdala)	0.0	0.0	0.0	0.0
Brain (cerebellum)	0.0	0.0	0.0	0.0
Brain (hippocampus)	0.0	0.0	0.0	0.4

Brain (substantia nigra)	4.6	0.0	0.0	0.4
Brain (thalamus)	0.0	0.0	0.0	0.0
Cerebral Cortex	0.0	0.0	0.0	0.5
Spinal cord	0.0	10.4	3.5	1.2
glio/astro U87-MG	0.0	0.0	0.0	0.0
glio/astro U-118-MG	12.4	0.0	10.7	8.5
astrocytoma SW1783	0.0	0.0	0.0	0.0
neuro*; met SK-N-AS	0.0	0.0	0.0	0.0
astrocytoma SF-539	0.0	0.0	0.0	0.0
astrocytoma SNB-75	0.0	0.0	0.0	2.5
glioma SNB-19	0.0	0.0	0.0	0.0
glioma U251	0.0	0.0	0.0	0.6
glioma SF-295	0.0	0.0	0.0	0.0
Heart (fetal)	5.8	0.0	0.0	0.0
Heart	0.0	0.0	0.0	0.5
Skeletal muscle (fetal)	0.0	0.0	0.0	0.3
Skeletal muscle	0.0	6.2	5.0	0.6
Bone marrow	100.0	100.0	66.4	0.0
Thymus	0.0	0.0	7.2	0.0
Spleen	11.4	8.8	21.2	0.0
Lymph node	5.0	7.4	0.0	1.3
Colorectal	0.0	0.0	0.0	0.3
Stomach	0.0	0.0	0.0	0.9
Small intestine	0.0	0.0	0.0	0.4
Colon ca. SW480	0.0	0.0	0.0	0.0
Colon ca.* SW620(SW480 met)	0.0	0.0	0.0	0.0
Colon ca. HT29	0.0	0.0	0.0	1.1
Colon ca. HCT-116	0.0	0.0	0.0	0.0
Colon ca. CaCo-2	0.0	0.0	0.0	0.8
Colon ca. tissue(ODO3866)	10.8	17.3	23.2	0.6
Colon ca. HCC-2998	0.0	0.0	0.0	1.4
Gastric ca.* (liver met) NCI-N87	0.0	0.0	1.8	100.0
Bladder	0.0	6.7	0.0	1.5
Trachea	0.0	0.0	31.6	1.2
Kidney	0.0	0.0	0.0	0.6
Kidney (fetal)	5.1	0.0	0.0	0.0

Renal ca. 786-0	0.0	0.0	0.0	0.0
Renal ca. A498	0.0	0.0	3.9	0.1
Renal ca. RXF 393	0.0	0.0	0.0	1.4
Renal ca. ACHN	0.0	0.0	0.0	24.7
Renal ca. UO-31	0.0	0.0	0.0	0.0
Renal ca. TK-10	0.0	0.0	0.0	0.0
Liver	0.0	0.0	0.0	0.0
Liver (fetal)	3.7	0.0	0.0	0.0
Liver ca. (hepatoblast) HepG2	0.0	0.0	0.0	0.0
Lung	38.4	25.0	100.0	1.3
Lung (fetal)	18.9	5.7	15.1	0.0
Lung ca. (small cell) LX-1	11.7	0.0	0.0	0.3
Lung ca. (small cell) NCI-H69	0.0	0.0	0.0	2.3
Lung ca. (s.cell var.) SHP-77	0.0	0.0	0.0	0.0
Lung ca. (large cell)NCI-H460	0.0	0.0	0.0	0.5
Lung ca. (non-sm. cell) A549	0.0	0.0	0.0	3.3
Lung ca. (non-s.cell) NCI-H23	38.2	17.9	10.2	21.5
Lung ca. (non-s.cell) HOP-62	0.0	0.0	0.0	0.0
Lung ca. (non-s.cl) NCI-H522	0.0	0.0	0.0	0.3
Lung ca. (squam.) SW 900	0.0	0.0	0.0	2.2
Lung ca. (squam.) NCI-H596	0.0	0.0	0.0	0.5
Mammary gland	0.0	0.0	0.0	0.6
Breast ca.* (pl.ef) MCF-7	0.0	0.0	0.0	35.4
Breast ca.* (pl.ef) MDA-MB-231	0.0	0.0	0.0	0.0
Breast ca.* (pl.ef) T47D	0.0	0.0	0.0	5.6
Breast ca. BT-549	0.0	0.0	0.0	1.7
Breast ca. MDA-N	0.0	0.0	0.0	0.0
Ovary	0.0	0.0	0.0	2.3
Ovarian ca. OVCAR-3	0.0	0.0	0.0	17.7
Ovarian ca.	0.0	0.0	0.0	17.1

OVCAR-4				
Ovarian ca. OVCAR-5	0.0	0.0	0.0	0.9
Ovarian ca. OVCAR-8	0.0	0.0	0.0	4.4
Ovarian ca. IGROV-1	0.0	0.0	0.0	0.0
Ovarian ca.* (ascites) SK-OV-3	0.0	0.0	0.0	8.0
Uterus	0.0	0.0	0.0	3.0
Placenta	5.3	0.0	16.5	0.0
Prostate	0.0	0.0	0.0	0.0
Prostate ca.* (bone met)PC-3	0.0	0.0	0.0	32.8
Testis	5.3	0.0	0.0	1.3
Melanoma Hs688(A).T	0.0	0.0	0.0	0.0
Melanoma* (met) Hs688(B).T	0.0	0.0	0.0	0.0
Melanoma UACC-62	0.0	0.0	0.0	0.5
Melanoma M14	0.0	0.0	0.0	0.6
Melanoma LOX IMVI	0.0	0.0	0.0	0.0
Melanoma* (met) SK-MEL-5	0.0	0.0	0.0	0.0
Adipose	27.0	14.3	10.7	4.0

Table AJ. Panel 2D

Tissue Name	Rel. Exp.(%) Ag1456, Run 147644930	Rel. Exp.(%) Ag1456, Run 148059395	Rel. Exp.(%) Ag1456, Run 162599938	Tissue Name	Rel. Exp.(%) Ag1456, Run 147644930	Rel. Exp.(%) Ag1456, Run 148059395	Rel. Exp.(%) Ag1456, Run 162599938
Normal Colon	13.2	2.1	6.3	Kidney Margin 8120608	0.0	0.6	1.0
CC Well to Mod Diff (ODO3866)	5.5	2.4	2.6	Kidney Cancer 8120613	1.0	0.8	0.8
CC Margin (ODO3866)	2.1	3.2	2.3	Kidney Margin 8120614	0.0	0.0	0.0
CC Gr.2 rectosigmoid (ODO3868)	0.6	0.0	1.7	Kidney Cancer 9010320	17.9	13.8	15.0



CC Margin (ODO3868)	0.0	0.0	0.8	Kidney Margin 9010321	0.7	1.4	1.4
CC Mod Diff (ODO3920)	1.8	2.9	3.5	Normal Uterus	0.0	0.0	0.0
CC Margin (ODO3920)	0.5	1.2	2.6	Uterus Cancer 064011	1.2	0.5	2.1
CC Gr.2 ascend colon (ODO3921)	1.3	9.2	6.5	Normal Thyroid	0.0	0.6	0.7
CC Margin (ODO3921)	0.0	0.5	1.7	Thyroid Cancer 064010	0.0	1.3	2.8
CC from Partial Hepatectomy (ODO4309) Mets	2.3	6.7	7.1	Thyroid Cancer A302152	1.9	0.6	3.0
Liver Margin (ODO4309)	3.2	7.3	2.3	Thyroid Margin A302153	0.0	0.0	1.9
Colon mets to lung (OD04451- 01)	1.3	0.6	0.0	Normal Breast	0.8	1.9	0.0
Lung Margin (OD04451- 02)	2.0	4.5	1.9	Breast Cancer (OD04566)	0.0	0.0	0.0
Normal Prostate 6546-1	0.0	0.0	0.0	Breast Cancer (OD04590- 01)	0.0	1.9	0.0
Prostate Cancer (OD04410)	0.7	0.0	2.9	Breast Cancer Mets (OD04590- 03)	0.9	0.5	1.4
Prostate Margin (OD04410)	0.6	0.0	0.0	Breast Cancer Metastasis (OD04655- 05)	1.1	0.6	1.7
Prostate Cancer (OD04720- 01)	0.6	0.0	0.0	Breast Cancer 064006	0.0	0.7	0.0

Prostate Margin (OD04720-02)	2.8	0.2	2.9	Breast Cancer 1024	0.7	0.0	0.9
Normal Lung 061010	7.4	8.2	0.0	Breast Cancer 9100266	0.0	0.0	0.0
Lung Met to Muscle (ODO4286)	6.1	2.0	5.8	Breast Margin 9100265	0.7	0.0	0.0
Muscle Margin (ODO4286)	1.5	0.6	1.1	Breast Cancer A209073	0.8	0.0	0.0
Lung Malignant Cancer (OD03126)	9.9	7.3	4.1	Breast Margin A2090734	0.0	0.0	0.0
Lung Margin (OD03126)	33.9	28.1	27.0	Normal Liver	0.0	0.0	1.1
Lung Cancer (OD04404)	13.3	11.2	13.0	Liver Cancer 064003	1.4	0.0	0.0
Lung Margin (OD04404)	32.8	22.2	28.3	Liver Cancer 1025	0.0	0.0	0.8
Lung Cancer (OD04565)	4.5	1.3	5.7	Liver Cancer 1026	2.2	1.8	0.9
Lung Margin (OD04565)	0.0	7.2	4.9	Liver Cancer 6004-T	1.2	1.0	0.0
Lung Cancer (OD04237-01)	2.1	1.6	3.5	Liver Tissue 6004-N	1.1	0.7	2.7
Lung Margin (OD04237-02)	100.0	100.0	100.0	Liver Cancer 6005-T	0.0	0.0	0.8
Ocular Mel Met to Liver (ODO4310)	0.3	0.0	0.0	Liver Tissue 6005-N	0.0	0.0	0.6
Liver Margin (ODO4310)	1.9	0.6	0.7	Normal Bladder	3.9	1.8	8.4
Melanoma Mets to Lung (OD04321)	0.5	0.0	0.0	Bladder Cancer 1023	0.0	0.0	0.0
Lung Margin	22.8	27.5	24.5	Bladder	3.3	5.2	1.7



Kidney Margin (OD04450-03)	0.0	1.4	3.2	Stomach Margin 9060396	0.0	1.2	0.8
Kidney Cancer 8120607	0.0	0.0	0.0	Gastric Cancer 064005	4.3	5.6	3.9

Table AK. Panel 4D

Tissue Name	Rel. Exp.(%) Ag1456, Run 139309823	Rel. Exp.(%) Ag1456, Run 144691235	Rel. Exp.(%) Ag1899, Run 165870453	Rel. Exp.(%) Ag2059, Run 161426290	Rel. Exp.(%) Ag2132, Run 159366502	Rel. Exp.(%) Ag2444, Run 164320874
Secondary Th1 act	0.0	0.0	0.0	0.0	0.0	0.0
Secondary Th2 act	0.4	0.4	0.0	0.0	0.0	0.0
Secondary Tr1 act	0.0	0.0	0.0	0.0	0.0	0.0
Secondary Th1 rest	0.0	0.0	0.3	0.0	0.0	0.0
Secondary Th2 rest	6.1	4.8	2.4	0.8	2.7	0.0
Secondary Tr1 rest	0.4	0.0	0.3	0.0	1.4	0.0
Primary Th1 act	0.0	0.7	0.0	0.0	0.0	0.0
Primary Th2 act	1.5	0.3	0.6	0.0	0.0	0.0
Primary Tr1 act	0.0	0.6	0.1	0.0	0.0	0.0
Primary Th1 rest	4.5	4.1	7.9	3.0	5.3	0.0
Primary Th2 rest	6.5	2.9	3.7	6.3	1.1	41.5
Primary Tr1 rest	2.7	3.5	1.6	2.5	1.0	0.0
CD45RA CD4 lymphocyte act	0.0	0.0	0.0	0.0	0.0	0.0
CD45RO CD4 lymphocyte act	0.0	0.4	0.3	0.0	0.0	0.0
CD8 lymphocyte act	0.0	0.0	0.0	0.0	0.0	0.0
Secondary CD8 lymphocyte rest	0.5	0.0	0.2	0.0	0.0	0.0
Secondary CD8 lymphocyte act	0.6	0.0	0.0	0.0	0.0	0.0
CD4 lymphocyte none	3.1	1.1	1.4	5.1	0.0	0.0
2ry Th1/Th2/Tr1_anti-CD95 CH11	4.3	5.9	4.7	2.1	3.5	0.0
LAK cells rest	0.5	1.1	0.5	0.0	0.0	0.0
LAK cells IL-2	1.0	1.4	0.8	0.0	1.6	0.0
LAK cells IL-2+IL-12	1.0	0.9	0.2	0.0	0.0	0.0

LAK cells IL-2+IFN gamma	0.5	2.1	0.6	0.0	0.0	0.0
LAK cells IL-2+IL-18	1.0	0.4	0.4	0.0	0.0	0.0
LAK cells PMA/ionomycin	17.1	17.8	8.0	8.5	10.0	0.0
NK Cells IL-2 rest	0.0	0.0	0.2	1.2	0.0	0.0
Two Way MLR 3 day	0.0	0.0	0.0	1.5	0.0	38.7
Two Way MLR 5 day	0.0	0.3	0.0	0.0	0.0	0.0
Two Way MLR 7 day	0.0	0.5	0.0	0.0	0.0	0.0
PBMC rest	20.3	22.2	18.4	6.7	14.0	100.0
PBMC PWM	0.5	0.0	0.0	0.0	1.3	45.7
PBMC PHA-L	0.0	1.0	0.2	0.0	0.0	0.0
Ramos (B cell) none	36.1	48.6	21.0	0.0	7.2	44.1
Ramos (B cell) ionomycin	100.0	87.1	16.6	44.1	27.9	46.7
B lymphocytes PWM	0.5	0.0	0.0	1.6	0.0	0.0
B lymphocytes CD40L and IL-4	0.5	0.0	0.0	0.0	0.0	0.0
EOL-1 dbcAMP	0.0	0.0	0.2	0.0	0.0	0.0
EOL-1 dbcAMP PMA/ionomycin	0.4	0.0	0.6	1.1	1.2	0.0
Dendritic cells none	5.6	4.7	4.3	3.7	8.4	0.0
Dendritic cells LPS	3.0	1.8	2.3	3.7	1.8	30.1
Dendritic cells anti-CD40	2.6	3.2	2.0	4.7	0.0	0.0
Monocytes rest	97.3	100.0	100.0	100.0	100.0	82.4
Monocytes LPS	34.2	34.4	20.3	15.8	19.3	32.5
Macrophages rest	5.1	5.5	3.0	4.0	1.3	0.0
Macrophages LPS	7.5	9.7	4.8	3.0	0.0	0.0
HUVEC none	0.0	0.0	0.0	0.0	0.0	0.0
HUVEC starved	0.0	0.0	0.0	0.0	0.0	0.0
HUVEC IL-1beta	0.0	0.0	0.0	0.0	0.0	0.0
HUVEC IFN gamma	0.0	0.0	0.0	0.0	0.0	0.0
HUVEC TNF alpha + IFN gamma	0.0	0.0	0.0	0.0	0.0	0.0
HUVEC TNF	0.0	0.0	0.0	0.0	0.0	0.0

alpha + IL4						
HUVEC IL-11	0.0	0.0	0.0	0.0	0.0	0.0
Lung Microvascular EC none	0.0	0.0	0.0	0.0	0.0	0.0
Lung Microvascular EC TNFalpha + IL- 1beta	0.0	0.0	0.0	0.0	0.0	0.0
Microvascular Dermal EC none	0.0	0.0	0.0	0.0	0.0	0.0
Microvascular Dermal EC TNFalpha + IL- 1beta	0.0	0.0	0.0	0.0	0.0	0.0
Bronchial epithelium TNFalpha + IL1beta	0.0	0.0	0.0	0.0	0.0	0.0
Small airway epithelium none	0.5	0.5	0.5	0.0	0.0	0.0
Small airway epithelium TNFalpha + IL- 1beta	4.0	3.8	2.1	6.2	6.3	0.0
Coronary artery SMC rest	0.0	0.0	0.0	0.0	0.0	0.0
Coronary artery SMC TNFalpha + IL-1beta	0.0	0.0	0.0	0.0	0.0	0.0
Astrocytes rest	0.0	0.0	0.0	0.0	0.0	0.0
Astrocytes TNFalpha + IL- 1beta	0.0	0.0	0.0	0.0	0.0	0.0
KU-812 (Basophil) rest	0.0	0.0	0.0	0.0	0.0	0.0
KU-812 (Basophil) PMA/ionomycin	0.0	0.0	0.0	0.0	0.0	0.0
CCD1106 (Keratinocytes) none	0.0	0.0	0.0	0.0	0.0	0.0
CCD1106 (Keratinocytes) TNFalpha + IL- 1beta	0.0	0.4	0.2	0.0	0.0	0.0
Liver cirrhosis	5.4	5.4	6.9	3.0	1.4	0.0
Lupus kidney	0.4	0.4	0.9	0.0	0.0	0.0

NCI-H292 none	0.0	0.4	0.0	0.0	1.5	0.0
NCI-H292 IL-4	0.0	0.0	0.0	0.0	0.0	0.0
NCI-H292 IL-9	0.0	0.0	0.3	0.0	0.0	0.0
NCI-H292 IL-13	0.0	0.0	0.0	0.0	0.0	0.0
NCI-H292 IFN gamma	0.0	0.0	0.0	0.0	0.0	0.0
HPAEC none	0.0	0.0	0.0	0.0	0.0	0.0
HPAEC TNF alpha + IL-1 beta	0.0	0.0	0.0	0.0	0.0	0.0
Lung fibroblast none	0.0	0.0	0.0	0.0	0.0	0.0
Lung fibroblast TNF alpha + IL-1 beta	0.0	0.0	0.0	0.0	0.0	27.0
Lung fibroblast IL-4	0.0	0.0	0.0	0.0	0.0	0.0
Lung fibroblast IL-9	0.0	0.0	0.0	0.0	0.0	0.0
Lung fibroblast IL-13	0.0	0.0	0.0	0.0	0.0	0.0
Lung fibroblast IFN gamma	0.0	0.0	0.0	0.0	0.0	0.0
Dermal fibroblast CCD1070 rest	0.0	0.0	0.0	0.0	0.0	0.0
Dermal fibroblast CCD1070 TNF alpha	1.6	0.0	0.2	0.0	0.0	0.0
Dermal fibroblast CCD1070 IL-1 beta	0.0	0.0	0.0	0.0	0.0	0.0
Dermal fibroblast IFN gamma	0.0	0.0	0.1	0.0	0.0	0.0
Dermal fibroblast IL-4	0.5	0.0	0.0	0.0	0.0	0.0
IBD Colitis 2	0.6	0.0	1.4	0.0	0.0	0.0
IBD Crohn's	1.4	1.5	2.0	0.0	0.0	0.0
Colon	0.6	0.0	0.6	0.0	3.1	0.0
Lung	3.7	5.2	1.5	2.1	4.9	0.0
Thymus	0.5	0.0	0.2	0.0	0.0	0.0
Kidney	2.6	4.4	0.6	1.6	0.0	0.0

**AI\_comprehensive\_panel\_v1.0 Summary:** Ag 1456 Highest expression of the sggc\_draft\_ba186014\_20000730\_da1 transcript is found in normal colon tissue adjacent to tissue affected by Crohn's or ulcerative colitis (CTs=33). This transcript is also found in normal colon on panels 1.2 and 2D. Since this transcript appears to be down regulated in

diseased colon, therapeutic modulation of the expression or function of the this gene or its protein product, through the use protein therapeutics, could regulate normal homeostasis of this tissue and be beneficial for the treatment of inflammatory bowel diseases.

**CNS\_neurodegeneration\_v1.0 Summary:** Ag2446 Expressoin of the  
5 sggc\_draft\_ba186014\_20000730\_da1 gene is low/undetectable in all samples on this panel.  
(CTs>35). The amp plot indicates that there may have been a probe failure in this experiment.  
(Data not shown.)

**Panel 1.2 Summary:** Ag1456 Highest expression of the  
sggc\_draft\_ba186014\_20000730\_da1 gene is detected in bone marrow (CT=28.9).  
10 Furthermore, the difference in expression between heart (CT=31.2) and fetal heart  
tissue(CT=36.2) is significant in this panel. Thus, the expression of this gene could be used to  
distinguish bone marrow from the other samples in the panel. In addition, the expression of  
this gene could be used to distinguish adult heart tissue from fetal heart tissue.

The sggc\_draft\_ba186014\_20000730\_da1 gene is also expressed in many tissues with  
15 metabolic function, including the heart, fetal and adult liver, skeletal muscle and adrenal  
gland. The protein encoded by the sggc\_draft\_ba186014\_20000730\_da1 gene is a lipase  
homolog and may be involved in the dynamic mobilization of fat in these tissues. Therefore,  
administration of this gene product or an agonist designed to it could enhance lipolysis and  
may act as an effective therapy against obesity and lipodystrophy. Conversely, an antagonist  
20 of this gene product may be useful in the treatment of conditions involving excessive depletion  
of fat reserves, such as cachexia.

**Panel 1.3D Summary:** Ag1456/Ag2132/Ag2444Three out of four experiments using  
different probe and primer sets show expression of the sggc\_draft\_ba186014\_20000730\_da1  
gene in bone marrow (CTs=33-34) and the lung (CT=32.4). The high expression in bone  
25 marrow is consistent with its expression seen in Panel 1.2. Thus, the expression of this gene  
could be used to distinguish samples derived from bone marrow and lung from other tissues on  
this panel. Furthermore, expression of the sggc\_draft\_ba186014\_20000730\_da1 gene could be  
used to distinguish between adult and fetal lung tissue.

Ag2059/Ag2446 Expression of the gene is low/undetectable (Ct values >35) in all  
30 samples in Panel 1.3D (data not shown).

**Panel 2D Summary:** Ag1456 Three experiments with the same probe and primer  
produce results that are in excellent agreement, with highest expression of the  
sggc\_draft\_ba186014\_20000730\_da1 gene in normal lung tissue adjacent to a tumor (CTs=30-



31). In addition, the *sggc\_draft\_ba186014\_20000730\_da1* gene appears to be overexpressed in three pairs of normal lung tissue when compared to corresponding cancerous tissue. In addition, four of nine kidney cancers show overexpression of this gene when compared to their respective normal adjacent tissue. Thus, the expression of this gene could be used to distinguish normal lung tissue from malignant lung tissue as well as malignant kidney from normal kidney. Moreover, therapeutic modulation of the expression of the *sggc\_draft\_ba186014\_20000730\_da1* gene or its gene product, through the use of small molecule drugs, antibodies or protein therapeutics may be effective in the treatment of kidney cancer or lung cancer.

**Panel 4D Summary:** Ag1456/Ag1899/Ag2059/Ag2132 Multiple experiments with different probe and primer sets show highest expression of the *sggc\_draft\_ba186014\_20000730\_da1* gene in resting monocytes (CTs=29-32). The gene appears to be downregulated in these cells following LPS treatment (CTs=32-34) and is not expressed at detectable levels in macrophages. The protein encoded by *sggc\_draft\_ba186014\_20000730\_da1* gene is homologous to acidic lipases and may play a role in lipid metabolism, differentiation, and activities such as phagocytosis, of these cells. Therefore, therapeutic modulation of the expression or function of the *sggc\_draft\_ba186014\_20000730\_da1* gene or its protein product, through the use protein therapeutics, could regulate monocyte function and/or differentiation.

Conversely, modulation of the expression or activity of the putative protein encoded by this transcript by antibodies or small molecules can reduce or prevent the inflammatory symptoms associated with accumulation of monocytes observed in diseases such as asthma, allergies, inflammatory bowel disease, lupus erythematosus, or rheumatoid arthritis.

#### **B. CG51493-01/20708613\_EXT1: MEGF/ Flamingo/ Cadherin-like (NOV2)**

Expression of gene CG51493-01 was assessed using the primer-probe set Ag1988, described in Table BA. Results of the RTQ-PCR runs are shown in Tables BB, BC, BD, BE, BF and BG.

Table BA. Probe Name Ag1988

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-tcactgctatgtgcacatcaa-3'	2517	278
Probe	TET-5'-catcacagatgccaacactcatcgg-3'-TAMRA	2538	279
Reverse	5'-actgagtagtggggcactttgaa-3'	2570	280

Table BB. CNS\_neurodegeneration\_v1.0

<b>Tissue Name</b>	<b>Rel. Exp.(%) Ag1988, Run 207794916</b>	<b>Tissue Name</b>	<b>Rel. Exp.(%) Ag1988, Run 207794916</b>
AD 1 Hippo	9.9	Control (Path) 3 Temporal Ctx	5.5
AD 2 Hippo	23.8	Control (Path) 4 Temporal Ctx	28.7
AD 3 Hippo	7.2	AD 1 Occipital Ctx	10.0
AD 4 Hippo	6.7	AD 2 Occipital Ctx (Missing)	0.0
AD 5 Hippo	<b>100.0</b>	AD 3 Occipital Ctx	5.8
AD 6 Hippo	32.3	AD 4 Occipital Ctx	24.5
Control 2 Hippo	27.7	AD 5 Occipital Ctx	50.7
Control 4 Hippo	5.7	AD 6 Occipital Ctx	17.9
Control (Path) 3 Hippo	3.5	Control 1 Occipital Ctx	2.0
AD 1 Temporal Ctx	19.2	Control 2 Occipital Ctx	75.8
AD 2 Temporal Ctx	28.3	Control 3 Occipital Ctx	16.7
AD 3 Temporal Ctx	7.5	Control 4 Occipital Ctx	3.0
AD 4 Temporal Ctx	17.2	Control (Path) 1 Occipital Ctx	90.1
AD 5 Inf Temporal Ctx	92.7	Control (Path) 2 Occipital Ctx	8.7
AD 5 Sup Temporal Ctx	28.5	Control (Path) 3 Occipital Ctx	2.2
AD 6 Inf Temporal Ctx	37.6	Control (Path) 4 Occipital Ctx	14.7
AD 6 Sup Temporal Ctx	44.4	Control 1 Parietal Ctx	3.2
Control 1 Temporal Ctx	3.6	Control 2 Parietal Ctx	34.9
Control 2 Temporal Ctx	44.8	Control 3 Parietal Ctx	15.3
Control 3 Temporal Ctx	10.3	Control (Path) 1 Parietal Ctx	90.1
Control 3 Temporal Ctx	7.1	Control (Path) 2 Parietal Ctx	15.4
Control (Path) 1 Temporal Ctx	74.7	Control (Path) 3 Parietal Ctx	3.3
Control (Path) 2 Temporal Ctx	31.6	Control (Path) 4 Parietal Ctx	44.1

**Table BC. Panel 1.3D**

Tissue Name	Rel. Exp.(%) Ag1988, Run 147796787	Rel. Exp.(%) Ag1988, Run 148015671	Tissue Name	Rel. Exp.(%) Ag1988, Run 147796787	Rel. Exp.(%) Ag1988, Run 148015671
Liver adenocarcinoma	7.3	11.6	Kidney (fetal)	0.4	0.1
Pancreas	0.2	1.1	Renal ca. 786- 0	1.0	2.5
Pancreatic ca. CAPAN 2	2.9	8.0	Renal ca. A498	16.5	21.0
Adrenal gland	0.6	0.7	Renal ca. RXF 393	0.5	0.7
Thyroid	0.0	0.1	Renal ca. ACHN	18.0	17.8
Salivary gland	0.0	0.1	Renal ca. UO- 31	2.8	4.2
Pituitary gland	15.9	17.1	Renal ca. TK- 10	7.3	16.5
Brain (fetal)	15.2	17.2	Liver	0.0	0.0
Brain (whole)	13.6	22.4	Liver (fetal)	0.0	0.4
Brain (amygdala)	9.5	15.7	Liver ca. (hepatoblast) HepG2	11.6	18.9
Brain (cerebellum)	11.0	17.8	Lung	1.3	0.0
Brain (hippocampus)	15.1	29.9	Lung (fetal)	0.2	0.0
Brain (substantia nigra)	0.5	1.3	Lung ca. (small cell) LX-1	25.0	33.2
Brain (thalamus)	6.6	10.0	Lung ca. (small cell) NCI-H69	36.9	62.4
Cerebral Cortex	100.0	100.0	Lung ca. (s.cell var.) SHP-77	32.8	46.3
Spinal cord	1.5	1.4	Lung ca. (large cell)NCI-H460	0.0	1.4
glio/astro U87-MG	11.7	19.9	Lung ca. (non- sm. cell) A549	3.4	6.9
glio/astro U-118- MG	51.1	77.9	Lung ca. (non- s.cell) NCI- H23	26.8	43.5
astrocytoma SW1783	2.1	5.1	Lung ca. (non- s.cell) HOP-62	5.9	11.7
neuro*; met SK-N- AS	30.6	37.1	Lung ca. (non- s.cl) NCI- H522	12.0	26.2

astrocytoma SF-539	3.9	7.9	Lung ca. (squam.) SW 900	9.4	18.0
astrocytoma SNB-75	58.2	82.4	Lung ca. (squam.) NCI-H596	17.6	25.2
glioma SNB-19	5.4	5.0	Mammary gland	0.4	0.6
glioma U251	3.0	3.7	Breast ca.* (pl.ef) MCF-7	4.4	6.2
glioma SF-295	30.4	44.4	Breast ca.* (pl.ef) MDA-MB-231	7.4	8.2
Heart (fetal)	0.8	0.5	Breast ca.* (pl.ef) T47D	21.9	30.1
Heart	0.0	0.0	Breast ca. BT-549	14.1	14.1
Skeletal muscle (fetal)	0.9	2.2	Breast ca. MDA-N	14.2	17.4
Skeletal muscle	0.0	0.0	Ovary	0.8	0.8
Bone marrow	0.0	0.0	Ovarian ca. OVCAR-3	2.6	4.2
Thymus	0.1	0.2	Ovarian ca. OVCAR-4	0.4	1.2
Spleen	0.1	0.4	Ovarian ca. OVCAR-5	7.0	8.2
Lymph node	0.4	0.7	Ovarian ca. OVCAR-8	33.7	59.9
Colorectal	1.4	1.5	Ovarian ca. IGROV-1	0.4	1.1
Stomach	0.0	1.2	Ovarian ca.* (ascites) SK-OV-3	0.4	0.7
Small intestine	0.2	0.3	Uterus	0.1	0.2
Colon ca. SW480	31.9	45.7	Placenta	0.7	1.1
Colon ca.* SW620(SW480 met)	11.0	18.7	Prostate	0.0	0.0
Colon ca. HT29	5.2	10.6	Prostate ca.* (bone met)PC-3	2.0	5.1
Colon ca. HCT-116	0.8	2.8	Testis	4.5	5.6
Colon ca. CaCo-2	40.1	51.4	Melanoma Hs688(A).T	1.5	3.9
Colon ca.	7.7	10.2	Melanoma*	3.3	5.5

tissue(ODO3866)			(met) Hs688(B).T		
Colon ca. HCC-2998	32.3	27.5	Melanoma UACC-62	0.1	5.0
Gastric ca.* (liver met) NCI-N87	5.9	8.0	Melanoma M14	2.5	4.8
Bladder	0.3	0.6	Melanoma LOX IMVI	3.6	11.3
Trachea	0.0	0.4	Melanoma* (met) SK-MEL-5	3.8	5.8
Kidney	0.0	0.1	Adipose	0.2	0.3

Table BD. Panel 2D

Tissue Name	Rel. Exp.(%) Ag1988, Run 148015699	Rel. Exp.(%) Ag1988, Run 151268165	Tissue Name	Rel. Exp.(%) Ag1988, Run 148015699	Rel. Exp.(%) Ag1988, Run 151268165
Normal Colon	5.1	7.6	Kidney Margin 8120608	0.4	0.5
CC Well to Mod Diff (ODO3866)	12.7	12.5	Kidney Cancer 8120613	1.4	1.1
CC Margin (ODO3866)	0.7	2.0	Kidney Margin 8120614	1.6	1.2
CC Gr.2 rectosigmoid (ODO3868)	7.1	8.1	Kidney Cancer 9010320	2.5	1.1
CC Margin (ODO3868)	0.6	0.4	Kidney Margin 9010321	1.1	1.8
CC Mod Diff (ODO3920)	11.0	7.9	Normal Uterus	1.7	0.0
CC Margin (ODO3920)	6.0	2.8	Uterus Cancer 064011	3.2	3.3
CC Gr.2 ascend colon (ODO3921)	40.1	25.7	Normal Thyroid	0.2	0.5
CC Margin (ODO3921)	0.8	0.5	Thyroid Cancer 064010	2.3	2.1
CC from Partial Hepatectomy (ODO4309) Mets	1.4	1.3	Thyroid Cancer A302152	2.0	1.1
Liver Margin (ODO4309)	0.2	0.5	Thyroid Margin	2.5	1.0

			A302153		
Colon mets to lung (OD04451-01)	14.5	11.8	Normal Breast	4.1	3.5
Lung Margin (OD04451-02)	2.1	3.4	Breast Cancer (OD04566)	5.7	3.2
Normal Prostate 6546-1	0.9	0.6	Breast Cancer (OD04590-01)	100.0	100.0
Prostate Cancer (OD04410)	2.6	2.4	Breast Cancer Mets (OD04590-03)	63.7	56.3
Prostate Margin (OD04410)	1.7	2.0	Breast Cancer Metastasis (OD04655-05)	50.7	47.0
Prostate Cancer (OD04720-01)	1.6	2.2	Breast Cancer 064006	3.6	3.4
Prostate Margin (OD04720-02)	1.2	2.7	Breast Cancer 1024	4.0	7.1
Normal Lung 061010	1.3	1.4	Breast Cancer 9100266	26.2	27.2
Lung Met to Muscle (ODO4286)	5.7	4.7	Breast Margin 9100265	10.4	7.4
Muscle Margin (ODO4286)	0.2	1.0	Breast Cancer A209073	6.4	6.6
Lung Malignant Cancer (OD03126)	28.1	19.2	Breast Margin A2090734	2.4	3.4
Lung Margin (OD03126)	2.1	1.1	Normal Liver	0.4	0.3
Lung Cancer (OD04404)	2.9	1.4	Liver Cancer 064003	9.3	8.0
Lung Margin (OD04404)	0.8	0.7	Liver Cancer 1025	1.1	0.4
Lung Cancer (OD04565)	1.6	1.5	Liver Cancer 1026	1.6	1.0
Lung Margin (OD04565)	2.3	1.1	Liver Cancer 6004-T	0.9	0.5
Lung Cancer (OD04237-01)	12.9	10.8	Liver Tissue 6004-N	2.7	3.2
Lung Margin (OD04237-02)	1.7	0.9	Liver Cancer 6005-T	0.5	1.5
Ocular Mel Met to Liver (ODO4310)	0.7	0.6	Liver Tissue 6005-N	0.0	0.3
Liver Margin (ODO4310)	0.0	1.0	Normal Bladder	3.2	3.7

Melanoma Mets to Lung (OD04321)	25.0	16.2	Bladder Cancer 1023	6.2	3.9
Lung Margin (OD04321)	1.3	0.2	Bladder Cancer A302173	9.3	6.1
Normal Kidney	2.3	0.9	Bladder Cancer (OD04718-01)	58.6	41.2
Kidney Ca, Nuclear grade 2 (OD04338)	9.7	5.6	Bladder Normal Adjacent (OD04718-03)	2.6	0.4
Kidney Margin (OD04338)	0.8	1.4	Normal Ovary	1.2	0.5
Kidney Ca Nuclear grade 1/2 (OD04339)	1.3	1.4	Ovarian Cancer 064008	1.7	3.6
Kidney Margin (OD04339)	2.0	0.5	Ovarian Cancer (OD04768-07)	14.1	8.4
Kidney Ca, Clear cell type (OD04340)	1.5	0.9	Ovary Margin (OD04768-08)	1.3	0.6
Kidney Margin (OD04340)	0.8	2.5	Normal Stomach	2.6	3.5
Kidney Ca, Nuclear grade 3 (OD04348)	1.0	0.4	Gastric Cancer 9060358	2.4	2.2
Kidney Margin (OD04348)	1.1	1.4	Stomach Margin 9060359	1.9	0.8
Kidney Cancer (OD04622-01)	0.5	0.5	Gastric Cancer 9060395	18.3	17.7
Kidney Margin (OD04622-03)	0.0	0.2	Stomach Margin 9060394	6.9	3.7
Kidney Cancer (OD04450-01)	6.0	4.5	Gastric Cancer 9060397	11.0	12.7
Kidney Margin (OD04450-03)	1.0	0.8	Stomach Margin 9060396	0.5	0.6
Kidney Cancer 8120607	2.2	3.8	Gastric Cancer 064005	22.2	15.5

Table BE. Panel 3D

Tissue Name	Rel. Exp.(%)	Tissue Name	Rel. Exp.(%)
-------------	--------------	-------------	--------------

	<b>Ag1988, Run 170745547</b>		<b>Ag1988, Run 170745547</b>
Daoy- Medulloblastoma	0.6	Ca Ski- Cervical epidermoid carcinoma (metastasis)	7.0
TE671- Medulloblastoma	0.7	ES-2- Ovarian clear cell carcinoma	0.5
D283 Med- Medulloblastoma	3.3	Ramos- Stimulated with PMA/ionomycin 6h	0.9
PFSK-1- Primitive Neuroectodermal	0.7	Ramos- Stimulated with PMA/ionomycin 14h	0.3
XF-498- CNS	1.8	MEG-01- Chronic myelogenous leukemia (megakaryoblast)	0.3
SNB-78- Glioma	1.1	Raji- Burkitt's lymphoma	0.5
SF-268- Glioblastoma	1.6	Daudi- Burkitt's lymphoma	0.4
T98G- Glioblastoma	5.8	U266- B-cell plasmacytoma	1.6
SK-N-SH- Neuroblastoma (metastasis)	4.8	CA46- Burkitt's lymphoma	0.0
SF-295- Glioblastoma	3.0	RL- non-Hodgkin's B-cell lymphoma	0.0
Cerebellum	8.1	JM1- pre-B-cell lymphoma	0.0
Cerebellum	5.4	Jurkat- T cell leukemia	0.2
NCI-H292- Mucoepidermoid lung carcinoma	4.0	TF-1- Erythroleukemia	1.3
DMS-114- Small cell lung cancer	6.4	HUT 78- T-cell lymphoma	2.8
DMS-79- Small cell lung cancer	<b>100.0</b>	U937- Histiocytic lymphoma	0.2
NCI-H146- Small cell lung cancer	13.2	KU-812- Myelogenous leukemia	0.1
NCI-H526- Small cell lung cancer	17.0	769-P- Clear cell renal carcinoma	0.1
NCI-N417- Small cell lung cancer	4.3	Caki-2- Clear cell renal carcinoma	0.3
NCI-H82- Small cell lung cancer	2.3	SW 839- Clear cell renal carcinoma	0.0
NCI-H157- Squamous cell lung cancer (metastasis)	1.4	G401- Wilms' tumor	0.5
NCI-H1155- Large cell lung cancer	17.3	Hs766T- Pancreatic carcinoma (LN metastasis)	3.0
NCI-H1299- Large cell lung cancer	3.7	CAPAN-1- Pancreatic adenocarcinoma (liver metastasis)	1.7



NCI-H727- Lung carcinoid	3.9	SU86.86- Pancreatic carcinoma (liver metastasis)	0.4
NCI-UMC-11- Lung carcinoid	7.8	BxPC-3- Pancreatic adenocarcinoma	2.2
LX-1- Small cell lung cancer	5.6	HPAC- Pancreatic adenocarcinoma	3.5
Colo-205- Colon cancer	0.6	MIA PaCa-2- Pancreatic carcinoma	0.4
KM12- Colon cancer	0.9	CFPAC-1- Pancreatic ductal adenocarcinoma	0.4
KM20L2- Colon cancer	1.2	PANC-1- Pancreatic epithelioid ductal carcinoma	1.6
NCI-H716- Colon cancer	21.8	T24- Bladder carcinma (transitional cell)	2.0
SW-48- Colon adenocarcinoma	0.9	5637- Bladder carcinoma	1.8
SW1116- Colon adenocarcinoma	0.3	HT-1197- Bladder carcinoma	0.0
LS 174T- Colon adenocarcinoma	0.8	UM-UC-3- Bladder carcinma (transitional cell)	0.3
SW-948- Colon adenocarcinoma	0.0	A204- Rhabdomyosarcoma	4.8
SW-480- Colon adenocarcinoma	1.6	HT-1080- Fibrosarcoma	1.6
NCI-SNU-5- Gastric carcinoma	2.2	MG-63- Osteosarcoma	0.1
KATO III- Gastric carcinoma	5.3	SK-LMS-1- Leiomyosarcoma (vulva)	8.5
NCI-SNU-16- Gastric carcinoma	0.2	SJRH30- Rhabdomyosarcoma (met to bone marrow)	0.5
NCI-SNU-1- Gastric carcinoma	4.2	A431- Epidermoid carcinoma	0.0
RF-1- Gastric adenocarcinoma	0.0	WM266-4- Melanoma	3.3
RF-48- Gastric adenocarcinoma	0.3	DU 145- Prostate carcinoma (brain metastasis)	0.0
MKN-45- Gastric carcinoma	5.8	MDA-MB-468- Breast adenocarcinoma	0.0
NCI-N87- Gastric carcinoma	0.2	SCC-4- Squamous cell carcinoma of tongue	0.0
OVCAR-5- Ovarian carcinoma	0.0	SCC-9- Squamous cell carcinoma of tongue	0.0
RL95-2- Uterine carcinoma	0.5	SCC-15- Squamous cell carcinoma of tongue	0.0
HelaS3- Cervical adenocarcinoma	1.5	CAL 27- Squamous cell carcinoma of tongue	0.1

Table BF. Panel 4D

Tissue Name	Rel. Exp.(%) Ag1988, Run 152701692	Tissue Name	Rel. Exp.(%) Ag1988, Run 152701692
Secondary Th1 act	2.1	HUVEC IL-1beta	0.0
Secondary Th2 act	3.6	HUVEC IFN gamma	0.0
Secondary Tr1 act	3.3	HUVEC TNF alpha + IFN gamma	0.3
Secondary Th1 rest	1.0	HUVEC TNF alpha + IL4	1.2
Secondary Th2 rest	0.2	HUVEC IL-11	0.0
Secondary Tr1 rest	0.4	Lung Microvascular EC none	1.9
Primary Th1 act	5.8	Lung Microvascular EC TNFalpha + IL-1beta	1.5
Primary Th2 act	10.4	Microvascular Dermal EC none	0.8
Primary Tr1 act	4.5	Microvascular Dermal EC TNFalpha + IL-1beta	1.6
Primary Th1 rest	3.3	Bronchial epithelium TNFalpha + IL1beta	0.4
Primary Th2 rest	1.1	Small airway epithelium none	0.0
Primary Tr1 rest	2.1	Small airway epithelium TNFalpha + IL-1beta	7.4
CD45RA CD4 lymphocyte act	2.2	Coronary artery SMC rest	3.4
CD45RO CD4 lymphocyte act	2.3	Coronary artery SMC TNFalpha + IL-1beta	1.4
CD8 lymphocyte act	3.7	Astrocytes rest	7.6
Secondary CD8 lymphocyte rest	1.7	Astrocytes TNFalpha + IL-1beta	2.3
Secondary CD8 lymphocyte act	3.7	KU-812 (Basophil) rest	1.7
CD4 lymphocyte none	1.4	KU-812 (Basophil) PMA/ionomycin	6.0
2ry Th1/Th2/Tr1 _anti- CD95 CH11	2.0	CCD1106 (Keratinocytes) none	9.5
LAK cells rest	0.8	CCD1106 (Keratinocytes) TNFalpha + IL-1beta	2.4
LAK cells IL-2	3.9	Liver cirrhosis	1.1
LAK cells IL-2+IL-12	2.2	Lupus kidney	0.0
LAK cells IL-2+IFN gamma	5.9	NCI-H292 none	65.5
LAK cells IL-2+ IL-18	5.4	NCI-H292 IL-4	92.7
LAK cells	2.6	NCI-H292 IL-9	100.0

PMA/ionomycin			
NK Cells IL-2 rest	2.7	NCI-H292 IL-13	53.2
Two Way MLR 3 day	1.8	NCI-H292 IFN gamma	48.0
Two Way MLR 5 day	1.6	HPAEC none	0.0
Two Way MLR 7 day	3.4	HPAEC TNF alpha + IL-1 beta	1.1
PBMC rest	1.5	Lung fibroblast none	3.7
PBMC PWM	4.4	Lung fibroblast TNF alpha + IL-1 beta	2.7
PBMC PHA-L	2.3	Lung fibroblast IL-4	7.6
Ramos (B cell) none	18.3	Lung fibroblast IL-9	3.7
Ramos (B cell) ionomycin	88.3	Lung fibroblast IL-13	3.2
B lymphocytes PWM	14.1	Lung fibroblast IFN gamma	3.9
B lymphocytes CD40L and IL-4	3.6	Dermal fibroblast CCD1070 rest	3.1
EOL-1 dbcAMP	16.7	Dermal fibroblast CCD1070 TNF alpha	8.0
EOL-1 dbcAMP PMA/ionomycin	13.0	Dermal fibroblast CCD1070 IL-1 beta	5.9
Dendritic cells none	1.0	Dermal fibroblast IFN gamma	1.2
Dendritic cells LPS	0.3	Dermal fibroblast IL-4	1.9
Dendritic cells anti-CD40	1.0	IBD Colitis 2	0.1
Monocytes rest	1.1	IBD Crohn's	0.0
Monocytes LPS	1.1	Colon	6.4
Macrophages rest	0.8	Lung	3.7
Macrophages LPS	0.0	Thymus	1.2
HUVEC none	0.2	Kidney	1.9
HUVEC starved	0.4		

Table BG. Panel CNS\_1

Tissue Name	Rel. Exp.(%) Ag1988, Run 171628544	Tissue Name	Rel. Exp.(%) Ag1988, Run 171628544
BA4 Control	18.7	BA17 PSP	25.5
BA4 Control2	40.3	BA17 PSP2	16.6
BA4 Alzheimer's2	11.9	Sub Nigra Control	11.3
BA4 Parkinson's	34.4	Sub Nigra Control2	17.1
BA4 Parkinson's2	84.1	Sub Nigra Alzheimer's2	6.1
BA4	26.1	Sub Nigra	23.3

Huntington's		Parkinson's2	
BA4 Huntington's2	12.7	Sub Nigra Huntington's	34.2
BA4 PSP	4.7	Sub Nigra Huntington's2	17.1
BA4 PSP2	15.9	Sub Nigra PSP2	5.1
BA4 Depression	23.2	Sub Nigra Depression	2.1
BA4 Depression2	4.7	Sub Nigra Depression2	7.7
BA7 Control	61.6	Glob Palladus Control	6.8
BA7 Control2	26.2	Glob Palladus Control2	6.1
BA7 Alzheimer's2	13.3	Glob Palladus Alzheimer's	8.8
BA7 Parkinson's	18.8	Glob Palladus Alzheimer's2	3.8
BA7 Parkinson's2	62.9	Glob Palladus Parkinson's	57.4
BA7 Huntington's	66.9	Glob Palladus Parkinson's2	8.2
BA7 Huntington's2	54.7	Glob Palladus PSP	1.7
BA7 PSP	43.8	Glob Palladus PSP2	3.9
BA7 PSP2	30.4	Glob Palladus Depression	3.8
BA7 Depression	13.6	Temp Pole Control	10.5
BA9 Control	19.3	Temp Pole Control2	45.1
BA9 Control2	100.0	Temp Pole Alzheimer's	9.6
BA9 Alzheimer's	9.5	Temp Pole Alzheimer's2	2.6
BA9 Alzheimer's2	17.1	Temp Pole Parkinson's	36.9
BA9 Parkinson's	27.2	Temp Pole Parkinson's2	32.5
BA9 Parkinson's2	62.0	Temp Pole Huntington's	37.6
BA9 Huntington's	37.9	Temp Pole PSP	2.9
BA9 Huntington's2	19.3	Temp Pole PSP2	13.1
BA9 PSP	11.0	Temp Pole Depression2	11.7

BA9 PSP2	9.3	Cing Gyr Control	53.2
BA9 Depression	9.4	Cing Gyr Control2	40.1
BA9 Depression2	15.0	Cing Gyr Alzheimer's	12.1
BA17 Control	43.8	Cing Gyr Alzheimer's2	8.5
BA17 Control2	70.7	Cing Gyr Parkinson's	27.5
BA17 Alzheimer's2	15.7	Cing Gyr Parkinson's2	35.4
BA17 Parkinson's	40.6	Cing Gyr Huntington's	37.6
BA17 Parkinson's2	72.2	Cing Gyr Huntington's2	25.5
BA17 Huntington's	42.0	Cing Gyr PSP	14.3
BA17 Huntington's2	24.8	Cing Gyr PSP2	4.8
BA17 Depression	9.4	Cing Gyr Depression	14.0
BA17 Depression2	33.4	Cing Gyr Depression2	12.1

**CNS\_neurodegeneration\_v1.0 Summary:** Ag1988 The CG51493-01 gene is expressed most highly in the cerebral cortex, and exhibits brain preferential expression. No specific association is notable between gene expression level and Alzheimer's disease in CNS\_neurodegeneration\_v1.0 panel. Please see Panel 1.3D for discussion of potential utility of this gene in the central nervous system.

**Panel 1.3D Summary:** Ag1988 Two experiments with the same probe and primer produce results that are in excellent agreement, with highest expression of the CG51493-01 gene in the cerebral cortex (CTs=27-29). This peak expression of the gene in the cerebral cortex, combined with a dendritic field-defining function for flamingo, suggests that the flamingo homolog encoded by this gene may control dendritic field formation in the brain. Dendritic degeneration is a prominent feature of Alzheimer's disease. Since flamingo acts as an inhibitory molecule in the expansion of dendritic fields, targeting this gene product with inhibitory small molecules or antibodies may foster neurite outgrowth by interfering with this endogenous neurite outgrowth inhibitor. Thus, this may be useful in treating the pathological neurite degeneration of Alzheimer's disease or other neurodegenerative diseases.

Among tissues with metabolic function, this gene is moderately expressed in the pituitary (CTs=30) and fetal skeletal muscle (CTs=34). Furthermore, this gene is expressed at

much higher levels in fetal skeletal muscle than in adult skeletal muscle (CTs=40) and thus could potentially be used to differentiate between the two sources of the tissue.

This putative protein has a domain found in the extracellular part of some hormone receptors including the calcitonin receptor, corticotropin releasing factor receptor 1, diuretic hormone receptor, glucagon-like peptide 1 receptor, and parathyroid hormone peptide receptor. Thus, as a potential G-protein coupled receptor, this gene product may be a small molecule drug target for the treatment of diseases that involve the pituitary gland, including endocrine dysfunctions, diabetes, obesity, and growth and reproductive disorders.

Overall, there is a predominant expression pattern associated with cancer cell lines, when compared to normal adult tissues. Evidence for this are the clusters of expression of this gene in lung, renal, prostate and melanoma cell lines. This data suggest that the expression of this gene might be associated with these forms of cancer and thus, therapeutic modulation of this gene might be of use in the treatment of these cancers

**Panel 2D Summary:** Ag1988 The expression of the CG51493-01 is highest in breast cancer (CTs=28-29) in two experiments with the same probe and primer set. colon, breast and bladder cancers express this gene at a higher level than the normal adjacent tissue. These data indicate that the expression of this gene might be associated with these forms of cancer and could be used as a diagnostic marker. Furthermore, therapeutic modulation of this gene might be of use in the treatment of these cancers.

**Panel 3D Summary:** Ag1988 The CG51493-01 gene is widely expressed in the cancer cell lines on this panel including colon, lung, gastric, brain, uterine, pancreatic and some sarcoma cell lines. This suggests that expression of this gene is potentially useful for cell growth and proliferation and that expression of this gene might be associated with these cancer tissues. Thus, expression of this gene could potentially be used as a diagnostic marker and therapeutic modulation of this gene might be of use in the treatment of cancer.

**Panel 4D Summary:** Ag 1988 The expression of the CG51493-01 transcript is moderate in the pulmonary muco-epidermoid cell line NCI-H292 and is up-regulated by IL-4 and IL-9 treatment (CTs= 29.5). Both cytokines have been reported to induce mucin gene expression in this cell line and therefore have been postulated to contribute to the pathogenesis of chronic obstructive pulmonary disease, emphysema and asthma. This transcript encodes for a protocadherin flamingo 1 like molecule, which belongs to the cadherin family. Members of the cadherin family play an important role in specific cell-cell adhesion events. Thus, modulation of the expression levels or functionality of this putative protein through the

application of antibodies or small molecules may reduce or eliminate symptoms caused by inflammation in lung epithelia in chronic obstructive pulmonary disease, asthma, allergy, and emphysema.

5 This transcript is also moderately expressed in activated Ramos B cells and at a lower but still significant level in normal activated B cells. This suggests that therapeutics designed against this putative protein may reduce or prevent the accumulation of B cells in inflamed tissues and therefore be useful for the treatment of rheumatoid arthritis and lupus.

**Panel CNS\_1 Summary:** Ag1988 This panel confirms expression of this gene in the brain. See Panel 1.3D for discussion of utility of this gene in the central nervous system.

#### 10 C. CG55806-01: Human Factor IX (NOV3)

Expression of gene CG55806-01 was assessed using the primer-probe set Ag2613, described in Table CA. Results of the RTQ-PCR runs are shown in Tables CB, CC and CD.

Table CA. Probe Name Ag2613

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-agccacatgtcttcgatctaca-3'	937	281
Probe	TET-5'-acaacatgttctgtgctggcttccat-3'-TAMRA	975	282
Reverse	5'-cccactatctccttgacatgaa-3'	1015	283

Table CB. Panel 1.3D

Tissue Name	Rel. Exp.(%) Ag2613, Run 165672326	Tissue Name	Rel. Exp.(%) Ag2613, Run 165672326
Liver adenocarcinoma	0.0	Kidney (fetal)	10.7
Pancreas	0.0	Renal ca. 786-0	0.0
Pancreatic ca. CAPAN 2	0.0	Renal ca. A498	0.0
Adrenal gland	0.0	Renal ca. RXF 393	0.0
Thyroid	0.0	Renal ca. ACHN	0.0
Salivary gland	0.0	Renal ca. UO-31	0.0
Pituitary gland	0.0	Renal ca. TK-10	0.0
Brain (fetal)	0.0	Liver	100.0
Brain (whole)	0.0	Liver (fetal)	76.3
Brain (amygdala)	0.0	Liver ca. (hepatoblast) HepG2	0.0
Brain (cerebellum)	0.0	Lung	0.0
Brain (hippocampus)	0.0	Lung (fetal)	0.0
Brain (substantia nigra)	0.0	Lung ca. (small cell) LX-1	0.0
Brain (thalamus)	0.0	Lung ca. (small cell)	0.0

		NCI-H69	
Cerebral Cortex	0.0	Lung ca. (s.cell var.) SHP-77	0.3
Spinal cord	0.0	Lung ca. (large cell)NCI-H460	0.0
glio/astro U87-MG	0.0	Lung ca. (non-sm. cell) A549	0.0
glio/astro U-118-MG	0.0	Lung ca. (non-s.cell) NCI-H23	0.0
astrocytoma SW1783	0.0	Lung ca. (non-s.cell) HOP-62	0.0
neuro*; met SK-N-AS	0.0	Lung ca. (non-s.cl) NCI-H522	0.0
astrocytoma SF-539	0.0	Lung ca. (squam.) SW 900	0.0
astrocytoma SNB-75	0.0	Lung ca. (squam.) NCI-H596	0.0
glioma SNB-19	0.0	Mammary gland	0.0
glioma U251	0.0	Breast ca.* (pl.ef) MCF-7	0.0
glioma SF-295	0.0	Breast ca.* (pl.ef) MDA-MB-231	0.2
Heart (fetal)	0.0	Breast ca.* (pl.ef) T47D	0.0
Heart	0.0	Breast ca. BT-549	0.0
Skeletal muscle (fetal)	0.0	Breast ca. MDA-N	0.0
Skeletal muscle	0.0	Ovary	0.0
Bone marrow	0.0	Ovarian ca. OVCAR- 3	0.0
Thymus	0.0	Ovarian ca. OVCAR- 4	0.0
Spleen	0.0	Ovarian ca. OVCAR- 5	0.0
Lymph node	0.0	Ovarian ca. OVCAR- 8	0.0
Colorectal	0.0	Ovarian ca. IGROV- 1	0.0
Stomach	0.0	Ovarian ca.* (ascites) SK-OV-3	0.0
Small intestine	0.0	Uterus	0.0
Colon ca. SW480	0.0	Placenta	0.0
Colon ca.* SW620(SW480 met)	0.0	Prostate	0.0
Colon ca. HT29	0.0	Prostate ca.* (bone met)PC-3	0.0



Colon ca. HCT-116	0.0	Testis	0.0
Colon ca. CaCo-2	0.0	Melanoma Hs688(A).T	0.0
Colon ca. tissue(ODO3866)	0.0	Melanoma* (met) Hs688(B).T	0.0
Colon ca. HCC-2998	0.0	Melanoma UACC-62	0.0
Gastric ca.* (liver met) NCI-N87	0.0	Melanoma M14	0.0
Bladder	0.0	Melanoma LOX IMVI	0.0
Trachea	0.0	Melanoma* (met) SK-MEL-5	0.0
Kidney	0.0	Adipose	0.0

Table CC. Panel 2.2

Tissue Name	Rel. Exp.(%) Ag2613, Run 175128272	Tissue Name	Rel. Exp.(%) Ag2613, Run 175128272
Normal Colon	0.4	Kidney Margin (OD04348)	0.0
Colon cancer (OD06064)	0.0	Kidney malignant cancer (OD06204B)	0.0
Colon Margin (OD06064)	0.0	Kidney normal adjacent tissue (OD06204E)	0.0
Colon cancer (OD06159)	0.0	Kidney Cancer (OD04450-01)	0.0
Colon Margin (OD06159)	0.0	Kidney Margin (OD04450-03)	0.0
Colon cancer (OD06297-04)	0.0	Kidney Cancer 8120613	0.0
Colon Margin (OD06297-015)	0.0	Kidney Margin 8120614	0.0
CC Gr.2 ascend colon (ODO3921)	0.0	Kidney Cancer 9010320	0.0
CC Margin (ODO3921)	0.0	Kidney Margin 9010321	0.0
Colon cancer metastasis (OD06104)	0.0	Kidney Cancer 8120607	0.0
Lung Margin (OD06104)	0.0	Kidney Margin 8120608	0.0
Colon mets to lung (OD04451-01)	0.1	Normal Uterus	0.1
Lung Margin (OD04451-02)	0.0	Uterine Cancer 064011	0.0
Normal Prostate	0.0	Normal Thyroid	0.0
Prostate Cancer	0.0	Thyroid Cancer 064010	0.0

(OD04410)			
Prostate Margin (OD04410)	0.0	Thyroid Cancer A302152	0.0
Normal Ovary	0.0	Thyroid Margin A302153	0.0
Ovarian cancer (OD06283-03)	0.0	Normal Breast	0.0
Ovarian Margin (OD06283-07)	0.0	Breast Cancer (OD04566)	1.5
Ovarian Cancer 064008	2.1	Breast Cancer 1024	0.0
Ovarian cancer (OD06145)	1.0	Breast Cancer (OD04590-01)	0.2
Ovarian Margin (OD06145)	0.2	Breast Cancer Mets (OD04590-03)	0.0
Ovarian cancer (OD06455-03)	0.0	Breast Cancer Metastasis (OD04655- 05)	0.0
Ovarian Margin (OD06455-07)	0.0	Breast Cancer 064006	0.1
Normal Lung	0.2	Breast Cancer 9100266	0.0
Invasive poor diff. lung adeno (ODO4945-01)	0.0	Breast Margin 9100265	0.0
Lung Margin (ODO4945-03)	0.0	Breast Cancer A209073	0.0
Lung Malignant Cancer (OD03126)	0.0	Breast Margin A2090734	0.0
Lung Margin (OD03126)	0.0	Breast cancer (OD06083)	0.0
Lung Cancer (OD05014A)	0.0	Breast cancer node metastasis (OD06083)	0.0
Lung Margin (OD05014B)	0.4	Normal Liver	100.0
Lung cancer (OD06081)	0.0	Liver Cancer 1026	1.9
Lung Margin (OD06081)	0.0	Liver Cancer 1025	60.3
Lung Cancer (OD04237-01)	0.0	Liver Cancer 6004-T	42.6
Lung Margin (OD04237-02)	0.0	Liver Tissue 6004-N	1.4
Ocular Melanoma Metastasis	0.0	Liver Cancer 6005-T	3.3
Ocular Melanoma Margin (Liver)	51.4	Liver Tissue 6005-N	33.7
Melanoma Metastasis	0.0	Liver Cancer 064003	59.0
Melanoma Margin (Lung)	0.0	Normal Bladder	0.0

Normal Kidney	0.0	Bladder Cancer 1023	0.0
Kidney Ca, Nuclear grade 2 (OD04338)	0.0	Bladder Cancer A302173	0.0
Kidney Margin (OD04338)	0.0	Normal Stomach	0.1
Kidney Ca Nuclear grade 1/2 (OD04339)	0.0	Gastric Cancer 9060397	0.0
Kidney Margin (OD04339)	0.0	Stomach Margin 9060396	0.0
Kidney Ca, Clear cell type (OD04340)	0.0	Gastric Cancer 9060395	0.2
Kidney Margin (OD04340)	0.0	Stomach Margin 9060394	0.0
Kidney Ca, Nuclear grade 3 (OD04348)	0.0	Gastric Cancer 064005	0.0

Table CD. Panel 4D

Tissue Name	Rel. Exp.(%) Ag2613, Run 164399517	Tissue Name	Rel. Exp.(%) Ag2613, Run 164399517
Secondary Th1 act	0.0	HUVEC IL-1beta	0.0
Secondary Th2 act	0.0	HUVEC IFN gamma	0.0
Secondary Tr1 act	0.0	HUVEC TNF alpha + IFN gamma	0.0
Secondary Th1 rest	0.0	HUVEC TNF alpha + IL4	0.0
Secondary Th2 rest	0.0	HUVEC IL-11	0.0
Secondary Tr1 rest	0.0	Lung Microvascular EC none	0.0
Primary Th1 act	0.0	Lung Microvascular EC TNFalpha + IL-1beta	0.0
Primary Th2 act	0.0	Microvascular Dermal EC none	0.0
Primary Tr1 act	0.0	Microvascular Dermal EC TNFalpha + IL-1beta	0.0
Primary Th1 rest	0.0	Bronchial epithelium TNFalpha + IL1beta	0.0
Primary Th2 rest	0.0	Small airway epithelium none	0.0
Primary Tr1 rest	0.0	Small airway epithelium TNFalpha + IL-1beta	0.0
CD45RA CD4 lymphocyte act	0.0	Coronary artery SMC rest	0.0
CD45RO CD4 lymphocyte act	0.0	Coronary artery SMC TNFalpha + IL-1beta	0.0
CD8 lymphocyte act	0.0	Astrocytes rest	0.0

Secondary CD8 lymphocyte rest	0.0	Astrocytes TNFalpha + IL-1beta	0.0
Secondary CD8 lymphocyte act	0.0	KU-812 (Basophil) rest	0.0
CD4 lymphocyte none	0.0	KU-812 (Basophil) PMA/ionomycin	0.0
2ry Th1/Th2/Tr1_anti-CD95 CH11	0.0	CCD1106 (Keratinocytes) none	0.0
LAK cells rest	0.0	CCD1106 (Keratinocytes) TNFalpha + IL-1beta	0.0
LAK cells IL-2	0.0	Liver cirrhosis	<b>100.0</b>
LAK cells IL-2+IL-12	0.0	Lupus kidney	0.0
LAK cells IL-2+IFN gamma	0.0	NCI-H292 none	0.0
LAK cells IL-2+ IL-18	0.0	NCI-H292 IL-4	0.0
LAK cells PMA/ionomycin	0.0	NCI-H292 IL-9	0.0
NK Cells IL-2 rest	0.0	NCI-H292 IL-13	0.0
Two Way MLR 3 day	0.0	NCI-H292 IFN gamma	0.0
Two Way MLR 5 day	0.0	HPAEC none	0.0
Two Way MLR 7 day	0.0	HPAEC TNF alpha + IL-1 beta	0.0
PBMC rest	0.0	Lung fibroblast none	0.0
PBMC PWM	0.0	Lung fibroblast TNF alpha + IL-1 beta	0.0
PBMC PHA-L	0.0	Lung fibroblast IL-4	0.0
Ramos (B cell) none	0.0	Lung fibroblast IL-9	0.0
Ramos (B cell) ionomycin	0.0	Lung fibroblast IL-13	0.0
B lymphocytes PWM	0.0	Lung fibroblast IFN gamma	0.0
B lymphocytes CD40L and IL-4	0.0	Dermal fibroblast CCD1070 rest	0.0
EOL-1 dbcAMP	0.0	Dermal fibroblast CCD1070 TNF alpha	0.0
EOL-1 dbcAMP PMA/ionomycin	0.0	Dermal fibroblast CCD1070 IL-1 beta	0.0
Dendritic cells none	0.0	Dermal fibroblast IFN gamma	0.0
Dendritic cells LPS	0.0	Dermal fibroblast IL-4	0.0
Dendritic cells anti-CD40	0.0	IBD Colitis 2	0.0
Monocytes rest	0.0	IBD Crohn's	0.0
Monocytes LPS	0.0	Colon	0.0
Macrophages rest	0.0	Lung	1.0

Macrophages LPS	0.0	Thymus	0.0
HUVEC none	0.0	Kidney	0.0
HUVEC starved	0.0		

**Panel 1.3D Summary:** Ag2613 Expression of the CG55806-01 gene is limited to the liver and fetal kidney samples on this panel(CTs=27-31). This gene encodes a protein that is homologous to factor IX. The secreted form of the protein may be present in the circulatory system and exhibit effects that are unrelated to the site of synthesis. Based on the expression profile of this gene, expression of this gene could be used to differentiate between liver derived tissue and other tissues. Furthermore, therapeutic modulation of the expression or function of this gene product may be effective in correcting the alterations to coagulation system seen in hemophilia and other liver related disease.

**Panel 2.2 Summary:** Ag2613 Expression of the CG55806-01 gene is highest in samples derived from liver (CT=27.9), a result that is consistent with the results seen in Panel 1.3D. Therefore, expression of this gene could be used to differentiate between normal sections of liver as compared to tumors that are secondary metastases from other sites (such as melanoma).

**Panel 4D Summary:** Ag2613 The CG55806-01 transcript is highly expressed in cirrhotic liver tissue (CT=27.8). This liver specific expression is also seen in the previous panels, suggesting that this transcript or the protein it encodes could be used as a diagnostic marker for liver tissue.

#### **D. CG55936-01: Carbonic Anhydrase IV precursor (NOV4)**

Expression of gene CG55936-01 was assessed using the primer-probe set Ag1677, described in Table DA. Results of the RTQ-PCR runs are shown in Tables DB, DC, DD, DE and DF.

Table DA. Probe Name Ag1677

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-cccattcagcttcacagaga-3'	260	284
Probe	TET-5'-cagatcctggcattctctcagaagctg-3'-TAMRA	232	285
Reverse	5'-atgctcactgtctgttccttgt-3'	203	286

Table DB. CNS\_neurodegeneration\_v1.0

Tissue Name	Rel. Exp.(%) Ag1677, Run 209733901	Tissue Name	Rel. Exp.(%) Ag1677, Run 209733901
AD 1 Hippo	9.9	Control (Path) 3 Temporal Ctx	8.2

AD 2 Hippo	16.7	Control (Path) 4 Temporal Ctx	75.8
AD 3 Hippo	5.3	AD 1 Occipital Ctx	14.4
AD 4 Hippo	26.2	AD 2 Occipital Ctx (Missing)	2.5
AD 5 Hippo	40.6	AD 3 Occipital Ctx	5.9
AD 6 Hippo	15.6	AD 4 Occipital Ctx	48.6
Control 2 Hippo	19.9	AD 5 Occipital Ctx	20.3
Control 4 Hippo	21.8	AD 6 Occipital Ctx	19.3
Control (Path) 3 Hippo	8.5	Control 1 Occipital Ctx	11.4
AD 1 Temporal Ctx	8.7	Control 2 Occipital Ctx	25.7
AD 2 Temporal Ctx	75.3	Control 3 Occipital Ctx	18.0
AD 3 Temporal Ctx	5.1	Control 4 Occipital Ctx	9.3
AD 4 Temporal Ctx	92.0	Control (Path) 1 Occipital Ctx	46.0
AD 5 Inf Temporal Ctx	100.0	Control (Path) 2 Occipital Ctx	48.0
AD 5 Sup Temporal Ctx	37.9	Control (Path) 3 Occipital Ctx	4.2
AD 6 Inf Temporal Ctx	19.5	Control (Path) 4 Occipital Ctx	7.8
AD 6 Sup Temporal Ctx	15.7	Control 1 Parietal Ctx	26.6
Control 1 Temporal Ctx	11.7	Control 2 Parietal Ctx	16.0
Control 2 Temporal Ctx	21.6	Control 3 Parietal Ctx	30.4
Control 3 Temporal Ctx	17.1	Control (Path) 1 Parietal Ctx	24.0
Control 3 Temporal Ctx	25.3	Control (Path) 2 Parietal Ctx	47.3
Control (Path) 1 Temporal Ctx	70.7	Control (Path) 3 Parietal Ctx	4.5
Control (Path) 2 Temporal Ctx	56.3	Control (Path) 4 Parietal Ctx	15.7

Table DC. General\_screening\_panel\_v1.4

Tissue Name	Rel. Exp.(%) Ag1677, Run 208021859	Tissue Name	Rel. Exp.(%) Ag1677, Run 208021859
Adipose	21.3	Renal ca. TK-10	0.6
Melanoma*	0.3	Bladder	6.3

Hs688(A).T			
Melanoma* Hs688(B).T	0.1	Gastric ca. (liver met.) NCI-N87	0.2
Melanoma* M14	0.1	Gastric ca. KATO III	0.1
Melanoma* LOXIMVI	0.2	Colon ca. SW-948	0.3
Melanoma* SK- MEL-5	0.7	Colon ca. SW480	0.2
Squamous cell carcinoma SCC-4	0.2	Colon ca.* (SW480 met) SW620	0.4
Testis Pool	4.7	Colon ca. HT29	1.3
Prostate ca.* (bone met) PC-3	0.3	Colon ca. HCT-116	0.4
Prostate Pool	3.0	Colon ca. CaCo-2	3.5
Placenta	6.3	Colon cancer tissue	1.9
Uterus Pool	2.0	Colon ca. SW1116	0.6
Ovarian ca. OVCAR-3	0.2	Colon ca. Colo-205	0.4
Ovarian ca. SK-OV- 3	0.2	Colon ca. SW-48	0.4
Ovarian ca. OVCAR-4	0.3	Colon Pool	6.2
Ovarian ca. OVCAR-5	0.3	Small Intestine Pool	3.8
Ovarian ca. IGROV- 1	0.6	Stomach Pool	3.8
Ovarian ca. OVCAR-8	0.8	Bone Marrow Pool	1.8
Ovary	1.8	Fetal Heart	19.1
Breast ca. MCF-7	24.0	Heart Pool	21.0
Breast ca. MDA- MB-231	0.4	Lymph Node Pool	4.7
Breast ca. BT 549	23.8	Fetal Skeletal Muscle	4.4
Breast ca. T47D	0.7	Skeletal Muscle Pool	14.0
Breast ca. MDA-N	0.7	Spleen Pool	2.5
Breast Pool	3.6	Thymus Pool	3.3
Trachea	2.7	CNS cancer (glio/astro) U87-MG	0.1
Lung	2.9	CNS cancer (glio/astro) U-118-MG	1.0
Fetal Lung	82.4	CNS cancer (neuro;met) SK-N-AS	0.1
Lung ca. NCI-N417	0.1	CNS cancer (astro) SF- 539	0.2
Lung ca. LX-1	0.2	CNS cancer (astro)	0.7

		SNB-75	
Lung ca. NCI-H146	0.2	CNS cancer (glio) SNB-19	1.3
Lung ca. SHP-77	31.6	CNS cancer (glio) SF-295	0.2
Lung ca. A549	0.9	Brain (Amygdala) Pool	12.1
Lung ca. NCI-H526	0.5	Brain (cerebellum)	100.0
Lung ca. NCI-H23	0.3	Brain (fetal)	3.0
Lung ca. NCI-H460	0.2	Brain (Hippocampus) Pool	8.4
Lung ca. HOP-62	0.2	Cerebral Cortex Pool	21.2
Lung ca. NCI-H522	0.0	Brain (Substantia nigra) Pool	22.7
Liver	0.4	Brain (Thalamus) Pool	14.5
Fetal Liver	0.7	Brain (whole)	22.1
Liver ca. HepG2	0.3	Spinal Cord Pool	5.3
Kidney Pool	14.8	Adrenal Gland	2.9
Fetal Kidney	19.6	Pituitary gland Pool	10.4
Renal ca. 786-0	0.4	Salivary Gland	5.1
Renal ca. A498	0.5	Thyroid (female)	39.5
Renal ca. ACHN	0.2	Pancreatic ca. CAPAN2	0.4
Renal ca. UO-31	0.2	Pancreas Pool	6.1

Table DD. Panel 1.3D

Tissue Name	Rel. Exp.(%) Ag1677, Run 152171910	Rel. Exp.(%) Ag1677, Run 165532764	Tissue Name	Rel. Exp.(%) Ag1677, Run 152171910	Rel. Exp.(%) Ag1677, Run 165532764
Liver adenocarcinoma	0.0	0.1	Kidney (fetal)	1.9	7.0
Pancreas	14.8	23.5	Renal ca. 786-0	0.0	0.0
Pancreatic ca. CAPAN 2	0.0	0.1	Renal ca. A498	0.0	0.2
Adrenal gland	2.1	3.3	Renal ca. RXF 393	0.0	1.0
Thyroid	36.1	37.1	Renal ca. ACHN	0.0	0.5
Salivary gland	3.2	10.0	Renal ca. UO-31	0.0	0.0
Pituitary gland	6.4	10.4	Renal ca. TK-10	0.0	0.3
Brain (fetal)	0.8	1.6	Liver	0.0	0.9
Brain (whole)	13.2	36.6	Liver (fetal)	0.0	1.9
Brain (amygdala)	4.6	17.9	Liver ca. (hepatoblast)	0.0	0.0



			HepG2		
Brain (cerebellum)	11.1	74.2	Lung	100.0	100.0
Brain (hippocampus)	23.8	30.6	Lung (fetal)	59.5	72.2
Brain (substantia nigra)	4.6	18.7	Lung ca. (small cell) LX-1	0.0	1.1
Brain (thalamus)	3.5	20.2	Lung ca. (small cell) NCI-H69	0.0	0.2
Cerebral Cortex	22.4	28.3	Lung ca. (s.cell var.) SHP-77	0.0	0.7
Spinal cord	0.9	6.9	Lung ca. (large cell) NCI-H460	0.0	0.7
glio/astro U87-MG	0.0	0.1	Lung ca. (non-sm. cell) A549	0.0	0.9
glio/astro U-118-MG	0.0	2.2	Lung ca. (non-s.cell) NCI-H23	0.2	1.0
astrocytoma SW1783	0.0	0.7	Lung ca. (non-s.cell) HOP-62	0.0	0.3
neuro*; met SK-N-AS	0.0	0.5	Lung ca. (non-s.cl) NCI-H522	0.0	0.8
astrocytoma SF-539	0.1	0.7	Lung ca. (squam.) SW 900	0.0	0.7
astrocytoma SNB-75	0.0	1.0	Lung ca. (squam.) NCI-H596	0.0	0.6
glioma SNB-19	0.0	1.0	Mammary gland	16.7	19.5
glioma U251	0.0	1.1	Breast ca.* (pl.ef) MCF-7	3.8	5.3
glioma SF-295	0.0	1.2	Breast ca.* (pl.ef) MDA-MB-231	0.0	0.2
Heart (fetal)	55.5	40.6	Breast ca.* (pl.ef) T47D	0.0	0.7
Heart	11.9	47.0	Breast ca. BT-549	0.4	2.2
Skeletal muscle (fetal)	41.2	22.7	Breast ca. MDA-N	0.0	0.9
Skeletal muscle	2.0	22.4	Ovary	3.5	3.1
Bone marrow	4.8	12.1	Ovarian ca. OVCAR-3	0.0	1.3

Thymus	0.4	1.9	Ovarian ca. OVCAR-4	0.0	0.0
Spleen	2.3	3.2	Ovarian ca. OVCAR-5	0.0	0.6
Lymph node	4.2	15.7	Ovarian ca. OVCAR-8	0.0	1.4
Colorectal	57.4	64.2	Ovarian ca. IGROV-1	0.0	0.3
Stomach	11.6	20.9	Ovarian ca.* (ascites) SK-OV-3	0.0	0.7
Small intestine	4.0	7.5	Uterus	2.5	19.6
Colon ca. SW480	0.0	0.1	Placenta	3.7	4.3
Colon ca.* SW620(SW480 met)	0.0	0.2	Prostate	4.5	8.4
Colon ca. HT29	0.0	0.2	Prostate ca.* (bone met)PC-3	0.0	0.2
Colon ca. HCT-116	0.0	0.9	Testis	0.5	3.2
Colon ca. CaCo-2	0.4	1.5	Melanoma Hs688(A).T	0.0	0.7
Colon ca. tissue(ODO3866)	0.9	3.0	Melanoma* (met) Hs688(B).T	0.0	0.0
Colon ca. HCC-2998	0.5	2.4	Melanoma UACC-62	0.0	0.4
Gastric ca.* (liver met) NCI-N87	0.0	0.6	Melanoma M14	0.0	0.2
Bladder	0.0	2.7	Melanoma LOX IMVI	0.0	0.6
Trachea	2.4	6.6	Melanoma* (met) SK-MEL-5	0.0	0.6
Kidney	9.6	37.9	Adipose	7.2	15.3

Table DE. Panel 2D

Tissue Name	Rel. Exp.(%) Ag1677, Run 152570595	Tissue Name	Rel. Exp.(%) Ag1677, Run 152570595
Normal Colon	63.3	Kidney Margin 8120608	26.6
CC Well to Mod Diff (ODO3866)	0.5	Kidney Cancer 8120613	2.3
CC Margin (ODO3866)	77.9	Kidney Margin	50.0

		8120614	
CC Gr.2 rectosigmoid (ODO3868)	5.3	Kidney Cancer 9010320	0.7
CC Margin (ODO3868)	2.2	Kidney Margin 9010321	26.2
CC Mod Diff (ODO3920)	29.5	Normal Uterus	0.6
CC Margin (ODO3920)	100.0	Uterus Cancer 064011	1.9
CC Gr.2 ascend colon (ODO3921)	30.6	Normal Thyroid	21.9
CC Margin (ODO3921)	42.9	Thyroid Cancer 064010	0.6
CC from Partial Hepatectomy (ODO4309) Mets	1.0	Thyroid Cancer A302152	1.1
Liver Margin (ODO4309)	0.0	Thyroid Margin A302153	14.5
Colon mets to lung (OD04451-01)	1.5	Normal Breast	6.6
Lung Margin (OD04451-02)	15.5	Breast Cancer (OD04566)	0.1
Normal Prostate 6546-1	3.3	Breast Cancer (OD04590-01)	0.6
Prostate Cancer (OD04410)	1.8	Breast Cancer Mets (OD04590-03)	5.1
Prostate Margin (OD04410)	1.4	Breast Cancer Metastasis (OD04655-05)	0.7
Prostate Cancer (OD04720-01)	0.5	Breast Cancer 064006	0.1
Prostate Margin (OD04720-02)	1.3	Breast Cancer 1024	5.6
Normal Lung 061010	36.3	Breast Cancer 9100266	0.3
Lung Met to Muscle (ODO4286)	0.1	Breast Margin 9100265	0.7
Muscle Margin (ODO4286)	2.7	Breast Cancer A209073	0.3
Lung Malignant Cancer (OD03126)	6.1	Breast Margin A2090734	1.3
Lung Margin (OD03126)	63.7	Normal Liver	0.0
Lung Cancer (OD04404)	3.5	Liver Cancer 064003	0.1
Lung Margin (OD04404)	17.3	Liver Cancer 1025	0.0
Lung Cancer (OD04565)	0.0	Liver Cancer 1026	0.0
Lung Margin (OD04565)	21.3	Liver Cancer 6004-T	0.2
Lung Cancer (OD04237-	0.2	Liver Tissue 6004-N	0.0

01)			
Lung Margin (OD04237-02)	17.9	Liver Cancer 6005-T	0.2
Ocular Mel Met to Liver (ODO4310)	0.1	Liver Tissue 6005-N	0.0
Liver Margin (ODO4310)	0.0	Normal Bladder	1.3
Melanoma Mets to Lung (OD04321)	0.1	Bladder Cancer 1023	0.0
Lung Margin (OD04321)	33.9	Bladder Cancer A302173	0.0
Normal Kidney	18.4	Bladder Cancer (OD04718-01)	0.2
Kidney Ca, Nuclear grade 2 (OD04338)	0.8	Bladder Normal Adjacent (OD04718-03)	0.6
Kidney Margin (OD04338)	19.3	Normal Ovary	2.3
Kidney Ca Nuclear grade 1/2 (OD04339)	0.1	Ovarian Cancer 064008	0.0
Kidney Margin (OD04339)	50.7	Ovarian Cancer (OD04768-07)	0.6
Kidney Ca, Clear cell type (OD04340)	14.9	Ovary Margin (OD04768-08)	0.1
Kidney Margin (OD04340)	34.4	Normal Stomach	1.9
Kidney Ca, Nuclear grade 3 (OD04348)	0.3	Gastric Cancer 9060358	0.2
Kidney Margin (OD04348)	13.9	Stomach Margin 9060359	0.8
Kidney Cancer (OD04622-01)	0.2	Gastric Cancer 9060395	0.1
Kidney Margin (OD04622-03)	4.8	Stomach Margin 9060394	1.2
Kidney Cancer (OD04450-01)	0.0	Gastric Cancer 9060397	3.9
Kidney Margin (OD04450-03)	15.0	Stomach Margin 9060396	0.5
Kidney Cancer 8120607	0.1	Gastric Cancer 064005	0.1

Table DF. Panel 4D

Tissue Name	Rel. Exp.(%) Ag1677, Run 152571252	Tissue Name	Rel. Exp.(%) Ag1677, Run 152571252
Secondary Th1 act	0.0	HUVEC IL-1beta	0.0
Secondary Th2 act	0.0	HUVEC IFN gamma	0.0

Secondary Tr1 act	0.0	HUVEC TNF alpha + IFN gamma	0.0
Secondary Th1 rest	0.0	HUVEC TNF alpha + IL4	0.0
Secondary Th2 rest	0.0	HUVEC IL-11	1.0
Secondary Tr1 rest	0.0	Lung Microvascular EC none	0.0
Primary Th1 act	0.0	Lung Microvascular EC TNFalpha + IL-1beta	0.0
Primary Th2 act	0.0	Microvascular Dermal EC none	0.5
Primary Tr1 act	0.0	Microvascular Dermal EC TNFalpha + IL-1beta	0.0
Primary Th1 rest	0.0	Bronchial epithelium TNFalpha + IL1beta	0.0
Primary Th2 rest	0.0	Small airway epithelium none	0.0
Primary Tr1 rest	0.0	Small airway epithelium TNFalpha + IL-1beta	0.0
CD45RA CD4 lymphocyte act	0.0	Coronary artery SMC rest	0.0
CD45RO CD4 lymphocyte act	0.0	Coronary artery SMC TNFalpha + IL-1beta	0.0
CD8 lymphocyte act	0.0	Astrocytes rest	0.0
Secondary CD8 lymphocyte rest	0.0	Astrocytes TNFalpha + IL-1beta	0.8
Secondary CD8 lymphocyte act	0.0	KU-812 (Basophil) rest	1.4
CD4 lymphocyte none	0.0	KU-812 (Basophil) PMA/ionomycin	0.0
2ry Th1/Th2/Tr1_anti-CD95 CH11	0.0	CCD1106 (Keratinocytes) none	0.0
LAK cells rest	0.0	CCD1106 (Keratinocytes) TNFalpha + IL-1beta	0.0
LAK cells IL-2	0.0	Liver cirrhosis	0.0
LAK cells IL-2+IL-12	0.0	Lupus kidney	10.5
LAK cells IL-2+IFN gamma	0.4	NCI-H292 none	0.0
LAK cells IL-2+ IL-18	0.0	NCI-H292 IL-4	0.0
LAK cells PMA/ionomycin	0.0	NCI-H292 IL-9	0.0
NK Cells IL-2 rest	0.0	NCI-H292 IL-13	0.0
Two Way MLR 3 day	0.0	NCI-H292 IFN gamma	0.0
Two Way MLR 5 day	0.0	HPAEC none	0.0
Two Way MLR 7 day	0.0	HPAEC TNF alpha + IL-1 beta	0.0

PBMC rest	0.0	Lung fibroblast none	0.0
PBMC PWM	0.0	Lung fibroblast TNF alpha + IL-1 beta	0.0
PBMC PHA-L	0.0	Lung fibroblast IL-4	0.0
Ramos (B cell) none	0.8	Lung fibroblast IL-9	0.0
Ramos (B cell) ionomycin	0.4	Lung fibroblast IL-13	0.0
B lymphocytes PWM	0.0	Lung fibroblast IFN gamma	0.0
B lymphocytes CD40L and IL-4	0.0	Dermal fibroblast CCD1070 rest	0.0
EOL-1 dbcAMP	0.0	Dermal fibroblast CCD1070 TNF alpha	0.0
EOL-1 dbcAMP PMA/ionomycin	0.0	Dermal fibroblast CCD1070 IL-1 beta	0.0
Dendritic cells none	0.0	Dermal fibroblast IFN gamma	0.0
Dendritic cells LPS	0.0	Dermal fibroblast IL-4	5.8
Dendritic cells anti-CD40	0.0	IBD Colitis 2	0.5
Monocytes rest	0.0	IBD Crohn's	0.0
Monocytes LPS	0.0	Colon	9.7
Macrophages rest	0.0	Lung	14.1
Macrophages LPS	0.0	Thymus	100.0
HUVEC none	0.0	Kidney	3.9
HUVEC starved	0.0		

**CNS\_neurodegeneration\_v1.0 Summary:** Ag1677 No change of expression of the CG55936-01 gene is noted in Alzheimer's disease, consistent with the scientific literature. However, this panel does confirm expression of this gene in the brain. Please see Panel 1.3D for discussion of utility of this gene in the central nervous system.

5 **General\_screening\_panel\_v1.4 Summary:** Ag1677 Highest expression of the CG55936-01 gene in this panel is seen in the cerebellum (CT=26.2), with expression also seen across all brain areas represented in this panel. This expression profile is consistent with the brain expression seen in the CNS\_neurodegeneration\_v1.0 panel. Please see Panel 1.3D for discussion of utility of this gene in the central nervous system.

10 Overall, this gene is expressed in normal tissues, with much lower expression in most cancer cell lines. This suggests that loss of expression of this gene might be required for the proliferation of these cancer cell lines. A moderate level of expression is seen in a lung cancer and two breast cancer cell lines. Thus, the loss of expression might be used as a diagnostic marker for most cancers, except the cancer tissues from which the lung and breast cancer cell

lines were derived. In addition, the protein product of this gene might be of use in the treatment of these cancers.

This gene is also moderately expressed in a wide variety of metabolic tissues including pancreas, adrenal, thyroid, pituitary, adult and fetal heart, adult and fetal skeletal muscle, adult and fetal liver, and adipose. Carbonic anhydrase III is reduced in adipose tissue in several animal models of genetic obesity. Thus, an activator of this gene product could potentially be a drug treatment for the prevention and/or treatment of obesity in humans.

In addition, this gene is expressed at higher levels in fetal lung (CT=26.5) than in adult lung (CT=31.3). Thus, expression of this gene could be used to differentiate between fetal and adult lung tissue. The expression of this gene at significant levels in the lung is consistent with published reports (see references below.) This suggests that the gene product is involved in the homeostasis of the lung. Therefore, therapeutic modulation of the expression or function of the protein encoded by this gene could be effective in treating disease that affect the lung or its function.

**Panel 1.3D Summary:** Ag1677 The expression of the CG55936-01 gene was assessed in two independent runs on this panel and there appears to be good concordance between runs. Overall, this gene is expressed in normal tissues, with much lower expression in most cancer cell lines. Highest expression of the gene in this panel is seen in the lung (CTs=28). This significant expression in the lung is consistent with the results in General\_screening\_panel\_v1.4 and suggests that this gene product is involved in the homeostasis of this organ. The higher association of this gene with normal tissues suggests that loss of expression of this gene might be required for the proliferation of the cancer cell lines in this panel. Thus, this loss of expression might be used as a diagnostic marker for cancer.

As in the previous panel, this gene is widely expressed in a variety of metabolic tissues including pancreas, adrenal, thyroid, pituitary, adult and fetal heart, adult and fetal skeletal muscle, and adipose. Thus, this gene product may be a small molecule target for the treatment of metabolic disease, including Types 1 and 2 diabetes.

This gene encodes a homolog of carbonic anhydrase, which is a known marker for oligodendroglia. Carbonic anhydrase expression in the brain is useful for distinguishing between neurons and oligodendroglia. Thus, this gene product may utility in monitoring the progression of diseases that involve the myelinating function of oligodendroglia, such as Multiple Sclerosis and Alzheimer's disease.

**Panel 2D Summary:** Ag1677 As in the previous panels, expression of the CG55936-01 gene is more highly associated with normal tissues. Highest expression of the gene in this panel is seen in a normal colon sample (CT=27.8). Furthermore, expression of this gene is higher in normal colon, stomach, ovary, thyroid, kidney and lung than in the corresponding adjacent tumor tissues. Thus, the loss of expression of this gene could be used to distinguish malignant colon, lung, stomach, ovary, thyroid, and kidney tissue from normal tissue from these organs. In addition, the protein product of this gene might be of use in the treatment of these cancers.

**Panel 4D Summary:** Ag1677 The CG55936-01 transcript is expressed at low but significant levels in the thymus, lung and kidney (CTs=30-35), again showing preferential expression in normal tissues. Thus, this gene or the protein it encodes could be used to detect these tissues. Therapeutically, the protein encoded for by this transcript could be used for immune modulation by regulating T cell development in the thymus.

#### **E. CG55784-01: neural cell adhesion molecule related protein (NOV5)**

Expression of gene CG55784-01 was assessed using the primer-probe set Ag2844, described in Table EA. Results of the RTQ-PCR runs are shown in Tables EB, EC, ED, and EE.

Table EA. Probe Name Ag2844

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-ctttccactgctctgcaaag-3'	113	287
Probe	TET-5'-aaccagctgtcaccagtagcaggtg-3'-TAMRA	136	288
Reverse	5'-gtcctgtacacctctccagatg-3'	191	289

Table EB. CNS\_neurodegeneration\_v1.0

Tissue Name	Rel. Exp.(%) Ag2844, Run 208699693	Tissue Name	Rel. Exp.(%) Ag2844, Run 208699693
AD 1 Hippo	15.1	Control (Path) 3 Temporal Ctx	2.6
AD 2 Hippo	29.1	Control (Path) 4 Temporal Ctx	21.5
AD 3 Hippo	3.6	AD 1 Occipital Ctx	8.8
AD 4 Hippo	7.3	AD 2 Occipital Ctx (Missing)	0.0
AD 5 hippo	45.7	AD 3 Occipital Ctx	3.3
AD 6 Hippo	22.5	AD 4 Occipital Ctx	24.0
Control 2 Hippo	32.5	AD 5 Occipital Ctx	12.2



Control 4 Hippo	7.7	AD 6 Occipital Ctx	55.9
Control (Path) 3 Hippo	3.4	Control 1 Occipital Ctx	1.1
AD 1 Temporal Ctx	15.1	Control 2 Occipital Ctx	40.6
AD 2 Temporal Ctx	30.4	Control 3 Occipital Ctx	12.1
AD 3 Temporal Ctx	4.7	Control 4 Occipital Ctx	5.6
AD 4 Temporal Ctx	25.9	Control (Path) 1 Occipital Ctx	59.5
AD 5 Inf Temporal Ctx	100.0	Control (Path) 2 Occipital Ctx	5.5
AD 5 Sup Temporal Ctx	35.4	Control (Path) 3 Occipital Ctx	0.7
AD 6 Inf Temporal Ctx	28.5	Control (Path) 4 Occipital Ctx	6.0
AD 6 Sup Temporal Ctx	23.7	Control 1 Parietal Ctx	5.2
Control 1 Temporal Ctx	3.4	Control 2 Parietal Ctx	37.4
Control 2 Temporal Ctx	48.6	Control 3 Parietal Ctx	14.3
Control 3 Temporal Ctx	13.4	Control (Path) 1 Parietal Ctx	59.5
Control 4 Temporal Ctx	6.5	Control (Path) 2 Parietal Ctx	16.6
Control (Path) 1 Temporal Ctx	77.9	Control (Path) 3 Parietal Ctx	2.3
Control (Path) 2 Temporal Ctx	37.6	Control (Path) 4 Parietal Ctx	27.0

Table EC. Panel 1.3D

Tissue Name	Rel. Exp.(%) Ag2844, Run 167819099	Tissue Name	Rel. Exp.(%) Ag2844, Run 167819099
Liver adenocarcinoma	0.0	Kidney (fetal)	1.3
Pancreas	0.3	Renal ca. 786-0	0.2
Pancreatic ca. CAPAN 2	0.0	Renal ca. A498	4.1
Adrenal gland	1.2	Renal ca. RXF 393	16.7
Thyroid	0.2	Renal ca. ACHN	28.5
Salivary gland	0.5	Renal ca. UO-31	0.4
Pituitary gland	0.0	Renal ca. TK-10	0.0
Brain (fetal)	68.3	Liver	0.0
Brain (whole)	80.1	Liver (fetal)	0.0

Brain (amygdala)	43.5	Liver ca. (hepatoblast) HepG2	0.0
Brain (cerebellum)	44.8	Lung	0.0
Brain (hippocampus)	42.6	Lung (fetal)	0.9
Brain (substantia nigra)	34.4	Lung ca. (small cell) LX-1	0.0
Brain (thalamus)	63.7	Lung ca. (small cell) NCI-H69	7.8
Cerebral Cortex	100.0	Lung ca. (s.cell var.) SHP-77	0.0
Spinal cord	17.2	Lung ca. (large cell)NCI-H460	0.0
glio/astro U87-MG	0.0	Lung ca. (non-sm. cell) A549	2.3
glio/astro U-118-MG	2.8	Lung ca. (non-s.cell) NCI-H23	0.0
astrocytoma SW1783	10.6	Lung ca. (non-s.cell) HOP-62	1.2
neuro*; met SK-N-AS	2.1	Lung ca. (non-s.cl) NCI-H522	0.0
astrocytoma SF-539	0.2	Lung ca. (squam.) SW 900	0.0
astrocytoma SNB-75	1.0	Lung ca. (squam.) NCI-H596	23.8
glioma SNB-19	2.4	Mammary gland	0.6
glioma U251	6.8	Breast ca.* (pl.ef) MCF-7	0.0
glioma SF-295	0.0	Breast ca.* (pl.ef) MDA-MB-231	0.0
Heart (fetal)	1.2	Breast ca.* (pl.ef) T47D	0.0
Heart	0.7	Breast ca. BT-549	0.0
Skeletal muscle (fetal)	0.5	Breast ca. MDA-N	0.0
Skeletal muscle	0.5	Ovary	0.0
Bone marrow	0.0	Ovarian ca. OVCAR- 3	0.0
Thymus	0.0	Ovarian ca. OVCAR- 4	0.0
Spleen	0.0	Ovarian ca. OVCAR- 5	5.6
Lymph node	0.3	Ovarian ca. OVCAR- 8	0.0
Colorectal	0.4	Ovarian ca. IGROV- 1	0.0
Stomach	0.0	Ovarian ca.* (ascites)	0.0

		SK-OV-3	
Small intestine	1.3	Uterus	0.0
Colon ca. SW480	0.0	Placenta	0.0
Colon ca.* SW620(SW480 met)	0.0	Prostate	0.2
Colon ca. HT29	0.0	Prostate ca.* (bone met)PC-3	0.0
Colon ca. HCT-116	0.0	Testis	0.0
Colon ca. CaCo-2	0.0	Melanoma Hs688(A).T	7.9
Colon ca. tissue(ODO3866)	0.5	Melanoma* (met) Hs688(B).T	2.6
Colon ca. HCC-2998	0.0	Melanoma UACC-62	0.0
Gastric ca.* (liver met) NCI-N87	0.0	Melanoma M14	0.0
Bladder	0.2	Melanoma LOX IMVI	0.0
Trachea	0.0	Melanoma* (met) SK-MEL-5	0.0
Kidney	0.0	Adipose	0.6

Table ED. Panel 4D

Tissue Name	Rel. Exp.(%) Ag2844, Run 164299480	Tissue Name	Rel. Exp.(%) Ag2844, Run 164299480
Secondary Th1 act	0.0	HUVEC IL-1beta	0.0
Secondary Th2 act	0.0	HUVEC IFN gamma	0.0
Secondary Tr1 act	0.0	HUVEC TNF alpha + IFN gamma	0.0
Secondary Th1 rest	0.0	HUVEC TNF alpha + IL4	0.0
Secondary Th2 rest	0.0	HUVEC IL-11	0.0
Secondary Tr1 rest	0.0	Lung Microvascular EC none	0.0
Primary Th1 act	0.0	Lung Microvascular EC TNFalpha + IL-1beta	0.0
Primary Th2 act	0.0	Microvascular Dermal EC none	0.0
Primary Tr1 act	0.0	Microsvascular Dermal EC TNFalpha + IL-1beta	0.0
Primary Th1 rest	0.0	Bronchial epithelium TNFalpha + IL1beta	0.0
Primary Th2 rest	0.0	Small airway epithelium none	0.0
Primary Tr1 rest	0.0	Small airway epithelium TNFalpha + IL-1beta	0.0

CD45RA CD4 lymphocyte act	43.5	Coronary artery SMC rest	1.7
CD45RO CD4 lymphocyte act	0.0	Coronary artery SMC TNFalpha + IL-1beta	5.1
CD8 lymphocyte act	0.0	Astrocytes rest	2.0
Secondary CD8 lymphocyte rest	0.0	Astrocytes TNFalpha + IL-1beta	3.7
Secondary CD8 lymphocyte act	0.0	KU-812 (Basophil) rest	0.0
CD4 lymphocyte none	0.0	KU-812 (Basophil) PMA/ionomycin	0.0
2ry Th1/Th2/Tr1_anti-CD95 CH11	0.0	CCD1106 (Keratinocytes) none	0.0
LAK cells rest	0.0	CCD1106 (Keratinocytes) TNFalpha + IL-1beta	0.0
LAK cells IL-2	0.0	Liver cirrhosis	0.3
LAK cells IL-2+IL-12	0.0	Lupus kidney	0.0
LAK cells IL-2+IFN gamma	0.0	NCI-H292 none	1.8
LAK cells IL-2+ IL-18	0.0	NCI-H292 IL-4	27.2
LAK cells PMA/ionomycin	0.0	NCI-H292 IL-9	3.7
NK Cells IL-2 rest	0.0	NCI-H292 IL-13	17.8
Two Way MLR 3 day	0.0	NCI-H292 IFN gamma	0.0
Two Way MLR 5 day	0.0	HPAEC none	0.0
Two Way MLR 7 day	0.0	HPAEC TNF alpha + IL-1 beta	0.0
PBMC rest	0.0	Lung fibroblast none	4.3
PBMC PWM	0.0	Lung fibroblast TNF alpha + IL-1 beta	3.4
PBMC PHA-L	0.0	Lung fibroblast IL-4	12.5
Ramos (B cell) none	0.0	Lung fibroblast IL-9	2.6
Ramos (B cell) ionomycin	0.0	Lung fibroblast IL-13	5.3
B lymphocytes PWM	0.0	Lung fibroblast IFN gamma	5.2
B lymphocytes CD40L and IL-4	0.0	Dermal fibroblast CCD1070 rest	90.1
EOL-1 dbcAMP	0.0	Dermal fibroblast CCD1070 TNF alpha	100.0
EOL-1 dbcAMP PMA/ionomycin	0.0	Dermal fibroblast CCD1070 IL-1 beta	39.8
Dendritic cells none	0.0	Dermal fibroblast IFN gamma	1.6
Dendritic cells LPS	0.0	Dermal fibroblast IL-4	4.5

Dendritic cells anti-CD40	0.0	IBD Colitis 2	0.0
Monocytes rest	0.0	IBD Crohn's	0.2
Monocytes LPS	0.0	Colon	1.3
Macrophages rest	0.0	Lung	0.0
Macrophages LPS	0.0	Thymus	0.4
HUVEC none	0.0	Kidney	0.5
HUVEC starved	0.0		

Table EF. Panel CNS\_1

Tissue Name	Rel. Exp.(%) Ag2844, Run 171669549	Tissue Name	Rel. Exp.(%) Ag2844, Run 171669549
BA4 Control	27.4	BA17 PSP	23.7
BA4 Control2	37.9	BA17 PSP2	8.0
BA4 Alzheimer's2	9.8	Sub Nigra Control	36.3
BA4 Parkinson's	32.1	Sub Nigra Control2	49.7
BA4 Parkinson's2	33.2	Sub Nigra Alzheimer's2	10.7
BA4 Huntington's	28.7	Sub Nigra Parkinson's2	56.3
BA4 Huntington's2	8.8	Sub Nigra Huntington's	66.4
BA4 PSP	6.3	Sub Nigra Huntington's2	17.0
BA4 PSP2	15.2	Sub Nigra PSP2	7.6
BA4 Depression	18.9	Sub Nigra Depression	5.4
BA4 Depression2	6.4	Sub Nigra Depression2	6.4
BA7 Control	58.6	Glob Palladus Control	20.3
BA7 Control2	18.7	Glob Palladus Control2	34.9
BA7 Alzheimer's2	6.4	Glob Palladus Alzheimer's	10.2
BA7 Parkinson's	18.8	Glob Palladus Alzheimer's2	9.6
BA7 Parkinson's2	44.1	Glob Palladus Parkinson's	100.0
BA7 Huntington's	66.9	Glob Palladus Parkinson's2	25.9
BA7 Huntington's2	25.2	Glob Palladus PSP	3.7
BA7 PSP	48.6	Glob Palladus PSP2	14.5

BA7 PSP2	34.2	Glob Palladus Depression	9.7
BA7 Depression	6.3	Temp Pole Control	14.9
BA9 Control	29.3	Temp Pole Control2	60.7
BA9 Control2	87.1	Temp Pole Alzheimer's	4.7
BA9 Alzheimer's	4.5	Temp Pole Alzheimer's2	5.0
BA9 Alzheimer's2	14.1	Temp Pole Parkinson's	28.5
BA9 Parkinson's	39.0	Temp Pole Parkinson's2	30.4
BA9 Parkinson's2	36.3	Temp Pole Huntington's	45.1
BA9 Huntington's	48.0	Temp Pole PSP	0.0
BA9 Huntington's2	12.4	Temp Pole PSP2	5.4
BA9 PSP	13.6	Temp Pole Depression2	5.2
BA9 PSP2	2.9	Cing Gyr Control	0.0
BA9 Depression	10.1	Cing Gyr Control2	36.6
BA9 Depression2	8.2	Cing Gyr Alzheimer's	15.3
BA17 Control	28.7	Cing Gyr Alzheimer's2	9.9
BA17 Control2	50.3	Cing Gyr Parkinson's	47.6
BA17 Alzheimer's2	5.3	Cing Gyr Parkinson's2	40.1
BA17 Parkinson's	26.2	Cing Gyr Huntington's	58.6
BA17 Parkinson's2	23.2	Cing Gyr Huntington's2	21.9
BA17 Huntington's	24.7	Cing Gyr PSP	11.6
BA17 Huntington's2	6.6	Cing Gyr PSP2	3.9
BA17 Depression	4.7	Cing Gyr Depression	8.0
BA17 Depression2	26.2	Cing Gyr Depression2	22.4

**CNS\_neurodegeneration\_v1.0 Summary:** Ag2844 While this panel shows no specific Alzheimer's association with the CG55784-01 gene, these results confirm expression of this gene in the brain. See Panel 1.3D for discussion of utility of this gene in the brain.

**Panel 1.3D Summary:** Ag2844 Highly brain-preferential expression of the CG55784-01 gene indicates a specific role for this gene product in the brain. This gene encodes a protein that is homologous to a neural cell adhesion molecule (NCAM). NCAM related proteins, such as Nr-CAM, play a critical role in neurite extension. Therefore, the introduction of ligands specific for this gene product, such as contactin, in directed brain regions may have utility in fostering focal neurite outgrowth. This may have utility in therapeutically countering neurite degeneration of neurodegenerative diseases such as Alzheimer's, ataxias, and Parkinson's disease.

In addition, the expression of this gene is relatively high in the normal brain samples compared to the cancer cell lines derived from brain cancer. Hence, expression of this gene can be used as a marker to differentiate between normal and cancerous tissue. There are also significantly higher levels of expression in renal cancer cell lines compared to a normal kidney sample. Therefore, expression of this gene may also be used as a marker in renal cancer.

**Panel 2.2 Summary:** Ag2844 Expression of the CG55784-01 gene is low/undetectable in all samples on this panel (CTs>35). (Data not shown.)

**Panel 4D Summary:** Ag2844 The CG55784-01 transcript is induced in IL-4 and IL-13 treated NCI-H292 cells, expressed constitutively in a dermal fibroblast cell line and appears to be slightly induced by IL-4 in lung fibroblasts. CD45RA (naive) T cells also express the transcript. The transcript encodes an NCAM-like molecule. Based on the expression pattern of the transcript, the homology to NCAM protein, and the regulation of transcript expression by IL-4 and IL-13, therapeutics designed with the protein encoded for by this transcript may be important in the treatment of asthma and COPD.

**Panel CNS\_1 Summary:** Ag2844 Expression in this panel further confirms widespread brain expression of the CG55784-01 gene. Please see Panel 1.3D for discussion of utility of this gene in the brain.

#### **F. CG55916-01: phospholipase (NOV6)**

Expression of gene CG55916-01 was assessed using the primer-probe set Ag2843, described in Table FA. Results of the RTQ-PCR runs are shown in Tables FB, FC, FD, FE, and FF.

**Table FA.** Probe Name Ag2843

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-accaatggatccactcctatct-3'	544	290

Probe	TET-5'-ctgactccaaccaggacagcaagatg-3'-TAMRA	574	291
Reverse	5'-attctcagcaggctcttgatct-3'	610	292

Table FB. CNS\_neurodegeneration\_v1.0

Tissue Name	Rel. Exp.(%) Ag2843, Run 209058882	Tissue Name	Rel. Exp.(%) Ag2843, Run 209058882
AD 1 Hippo	16.6	Control (Path) 3 Temporal Ctx	11.0
AD 2 Hippo	33.2	Control (Path) 4 Temporal Ctx	35.4
AD 3 Hippo	10.3	AD 1 Occipital Ctx	15.9
AD 4 Hippo	29.9	AD 2 Occipital Ctx (Missing)	0.3
AD 5 Hippo	38.4	AD 3 Occipital Ctx	11.2
AD 6 Hippo	100.0	AD 4 Occipital Ctx	19.8
Control 2 Hippo	30.6	AD 5 Occipital Ctx	20.7
Control 4 Hippo	48.6	AD 6 Occipital Ctx	18.6
Control (Path) 3 Hippo	9.5	Control 1 Occipital Ctx	9.2
AD 1 Temporal Ctx	24.1	Control 2 Occipital Ctx	34.2
AD 2 Temporal Ctx	20.0	Control 3 Occipital Ctx	17.1
AD 3 Temporal Ctx	8.8	Control 4 Occipital Ctx	18.2
AD 4 Temporal Ctx	12.1	Control (Path) 1 Occipital Ctx	45.1
AD 5 Inf Temporal Ctx	37.4	Control (Path) 2 Occipital Ctx	18.3
AD 5 Sup Temporal Ctx	38.7	Control (Path) 3 Occipital Ctx	6.7
AD 6 Inf Temporal Ctx	64.2	Control (Path) 4 Occipital Ctx	21.6
AD 6 Sup Temporal Ctx	59.0	Control 1 Parietal Ctx	13.8
Control 1 Temporal Ctx	7.0	Control 2 Parietal Ctx	33.9
Control 2 Temporal Ctx	16.7	Control 3 Parietal Ctx	11.9
Control 3 Temporal Ctx	11.7	Control (Path) 1 Parietal Ctx	30.1
Control 3 Temporal Ctx	25.9	Control (Path) 2 Parietal Ctx	18.9
Control (Path) 1 Temporal Ctx	26.6	Control (Path) 3 Parietal Ctx	9.0
Control (Path) 2	23.5	Control (Path) 4	40.6



Temporal Ctx		Parietal Ctx	
--------------	--	--------------	--

Table FC. Panel 1.3D

Tissue Name	Rel. Exp.(%) Ag2843, Run 161560324	Rel. Exp.(%) Ag2843, Run 165721033	Tissue Name	Rel. Exp.(%) Ag2843, Run 161560324	Rel. Exp.(%) Ag2843, Run 165721033
Liver adenocarcinoma	74.2	65.1	Kidney (fetal)	4.7	3.1
Pancreas	0.4	1.4	Renal ca. 786- 0	6.6	7.6
Pancreatic ca. CAPAN 2	18.2	49.7	Renal ca. A498	39.2	56.3
Adrenal gland	5.1	12.4	Renal ca. RXF 393	1.9	9.3
Thyroid	3.8	5.4	Renal ca. ACHN	19.5	39.0
Salivary gland	0.5	2.0	Renal ca. UO- 31	16.4	30.6
Pituitary gland	1.9	6.2	Renal ca. TK- 10	7.4	8.4
Brain (fetal)	2.3	9.3	Liver	0.0	0.9
Brain (whole)	9.3	23.3	Liver (fetal)	0.1	0.8
Brain (amygdala)	16.5	29.7	Liver ca. (hepatoblast) HepG2	12.6	33.2
Brain (cerebellum)	9.7	25.0	Lung	2.2	5.0
Brain (hippocampus)	22.4	41.8	Lung (fetal)	1.4	2.2
Brain (substantia nigra)	4.4	16.5	Lung ca. (small cell) LX-1	19.8	84.1
Brain (thalamus)	17.3	54.0	Lung ca. (small cell) NCI-H69	0.2	0.4
Cerebral Cortex	40.6	18.7	Lung ca. (s.cell var.) SHP-77	0.8	0.7
Spinal cord	46.7	58.6	Lung ca. (large cell)NCI-H460	14.3	59.0
glio/astro U87-MG	13.2	9.0	Lung ca. (non- sm. cell) A549	16.7	28.1
glio/astro U-118- MG	6.7	34.2	Lung ca. (non- s.cell) NCI- H23	2.1	1.8
astrocytoma SW1783	16.7	17.7	Lung ca. (non- s.cell) HOP-62	10.8	27.9

neuro*; met SK-N-AS	7.6	21.5	Lung ca. (non-s.cl) NCI-H522	11.3	13.0
astrocytoma SF-539	7.7	11.8	Lung ca. (squam.) SW 900	1.0	0.2
astrocytoma SNB-75	4.1	18.2	Lung ca. (squam.) NCI-H596	0.3	0.3
glioma SNB-19	19.3	24.3	Mammary gland	4.4	6.2
glioma U251	7.4	21.6	Breast ca.* (pl.ef) MCF-7	5.6	11.2
glioma SF-295	23.3	26.6	Breast ca.* (pl.ef) MDA-MB-231	13.2	52.9
Heart (fetal)	24.5	9.0	Breast ca.* (pl.ef) T47D	7.5	15.3
Heart	17.3	15.4	Breast ca. BT-549	2.6	11.0
Skeletal muscle (fetal)	100.0	20.0	Breast ca. MDA-N	2.3	2.6
Skeletal muscle	61.6	100.0	Ovary	31.6	7.5
Bone marrow	0.2	0.9	Ovarian ca. OVCAR-3	32.1	68.3
Thymus	2.6	0.4	Ovarian ca. OVCAR-4	7.9	39.0
Spleen	1.4	1.4	Ovarian ca. OVCAR-5	17.0	36.6
Lymph node	0.7	1.7	Ovarian ca. OVCAR-8	29.9	24.1
Colorectal	36.9	18.8	Ovarian ca. IGROV-1	4.7	6.8
Stomach	4.2	13.0	Ovarian ca.* (ascites) SK-OV-3	47.0	99.3
Small intestine	2.4	8.9	Uterus	2.9	15.1
Colon ca. SW480	15.9	28.9	Placenta	6.5	6.6
Colon ca.* SW620(SW480 met)	14.9	16.8	Prostate	4.8	5.2
Colon ca. HT29	38.4	17.2	Prostate ca.* (bone met)PC-3	27.5	86.5
Colon ca. HCT-116	15.1	28.1	Testis	12.3	17.3

Colon ca. CaCo-2	25.2	19.6	Melanoma Hs688(A).T	8.8	3.5
Colon ca. tissue(ODO3866)	37.9	26.1	Melanoma* (met) Hs688(B).T	14.4	15.6
Colon ca. HCC- 2998	15.6	20.3	Melanoma UACC-62	1.9	6.5
Gastric ca.* (liver met) NCI-N87	44.4	62.4	Melanoma M14	1.0	7.5
Bladder	8.9	6.3	Melanoma LOX IMVI	6.0	9.0
Trachea	11.5	13.8	Melanoma* (met) SK- MEL-5	1.3	3.7
Kidney	4.1	2.4	Adipose	4.6	5.6

Table FD. Panel 2D

Tissue Name	Rel. Exp.(%) Ag2843, Run 161590185	Tissue Name	Rel. Exp.(%) Ag2843, Run 161590185
Normal Colon	70.7	Kidney Margin 8120608	4.3
CC Well to Mod Diff (ODO3866)	30.6	Kidney Cancer 8120613	1.0
CC Margin (ODO3866)	30.6	Kidney Margin 8120614	7.3
CC Gr.2 rectosigmoid (ODO3868)	17.1	Kidney Cancer 9010320	18.6
CC Margin (ODO3868)	5.9	Kidney Margin 9010321	11.4
CC Mod Diff (ODO3920)	12.7	Normal Uterus	6.0
CC Margin (ODO3920)	48.0	Uterus Cancer 064011	6.7
CC Gr.2 ascend colon (ODO3921)	31.4	Normal Thyroid	7.4
CC Margin (ODO3921)	19.8	Thyroid Cancer 064010	66.9
CC from Partial Hepatectomy (ODO4309) Mets	17.8	Thyroid Cancer A302152	19.5
Liver Margin (ODO4309)	0.3	Thyroid Margin A302153	4.8
Colon mets to lung (OD04451-01)	15.0	Normal Breast	11.7
Lung Margin (OD04451- 02)	4.6	Breast Cancer (OD04566)	0.2
Normal Prostate 6546-1	6.2	Breast Cancer	59.5

		(OD04590-01)	
Prostate Cancer (OD04410)	6.3	Breast Cancer Mets (OD04590-03)	33.2
Prostate Margin (OD04410)	9.6	Breast Cancer Metastasis (OD04655-05)	14.4
Prostate Cancer (OD04720-01)	18.2	Breast Cancer 064006	6.7
Prostate Margin (OD04720-02)	16.7	Breast Cancer 1024	14.5
Normal Lung 061010	8.1	Breast Cancer 9100266	9.9
Lung Met to Muscle (ODO4286)	17.7	Breast Margin 9100265	6.0
Muscle Margin (ODO4286)	32.1	Breast Cancer A209073	10.4
Lung Malignant Cancer (OD03126)	12.2	Breast Margin A2090734	16.3
Lung Margin (OD03126)	7.3	Normal Liver	1.4
Lung Cancer (OD04404)	7.6	Liver Cancer 064003	0.6
Lung Margin (OD04404)	12.2	Liver Cancer 1025	0.6
Lung Cancer (OD04565)	16.0	Liver Cancer 1026	2.3
Lung Margin (OD04565)	7.9	Liver Cancer 6004-T	1.0
Lung Cancer (OD04237-01)	0.6	Liver Tissue 6004-N	2.3
Lung Margin (OD04237-02)	6.3	Liver Cancer 6005-T	3.1
Ocular Mel Met to Liver (ODO4310)	7.5	Liver Tissue 6005-N	0.2
Liver Margin (ODO4310)	0.3	Normal Bladder	10.6
Melanoma Mets to Lung (OD04321)	3.3	Bladder Cancer 1023	13.4
Lung Margin (OD04321)	15.0	Bladder Cancer A302173	3.2
Normal Kidney	7.6	Bladder Cancer (OD04718-01)	27.7
Kidney Ca, Nuclear grade 2 (OD04338)	26.6	Bladder Normal Adjacent (OD04718-03)	15.0
Kidney Margin (OD04338)	8.1	Normal Ovary	11.7
Kidney Ca Nuclear grade 1/2 (OD04339)	100.0	Ovarian Cancer 064008	73.2
Kidney Margin (OD04339)	6.7	Ovarian Cancer (OD04768-07)	4.8

Kidney Ca, Clear cell type (OD04340)	26.6	Ovary Margin (OD04768-08)	8.1
Kidney Margin (OD04340)	11.4	Normal Stomach	26.4
Kidney Ca, Nuclear grade 3 (OD04348)	7.7	Gastric Cancer 9060358	4.1
Kidney Margin (OD04348)	7.3	Stomach Margin 9060359	13.1
Kidney Cancer (OD04622-01)	21.0	Gastric Cancer 9060395	24.3
Kidney Margin (OD04622-03)	3.0	Stomach Margin 9060394	25.3
Kidney Cancer (OD04450-01)	21.2	Gastric Cancer 9060397	57.8
Kidney Margin (OD04450-03)	5.6	Stomach Margin 9060396	36.9
Kidney Cancer 8120607	42.3	Gastric Cancer 064005	25.7

Table FE. Panel 4D

Tissue Name	Rel. Exp.(%) Ag2843, Run 159616571	Tissue Name	Rel. Exp.(%) Ag2843, Run 159616571
Secondary Th1 act	0.6	HUVEC IL-1beta	3.8
Secondary Th2 act	1.1	HUVEC IFN gamma	5.1
Secondary Tr1 act	0.6	HUVEC TNF alpha + IFN gamma	1.4
Secondary Th1 rest	0.2	HUVEC TNF alpha + IL4	2.6
Secondary Th2 rest	0.2	HUVEC IL-11	5.6
Secondary Tr1 rest	0.5	Lung Microvascular EC none	18.4
Primary Th1 act	1.7	Lung Microvascular EC TNFalpha + IL-1beta	6.1
Primary Th2 act	2.4	Microvascular Dermal EC none	19.6
Primary Tr1 act	0.0	Microvascular Dermal EC TNFalpha + IL-1beta	6.3
Primary Th1 rest	0.3	Bronchial epithelium TNFalpha + IL1beta	9.9
Primary Th2 rest	1.4	Small airway epithelium none	20.7
Primary Tr1 rest	0.3	Small airway epithelium TNFalpha + IL-1beta	100.0
CD45RA CD4 lymphocyte act	6.3	Coronary artery SMC rest	6.1
CD45RO CD4	1.7	Coronary artery SMC	3.2

lymphocyte act		TNFalpha + IL-1beta	
CD8 lymphocyte act	1.3	Astrocytes rest	30.1
Secondary CD8 lymphocyte rest	0.6	Astrocytes TNFalpha + IL-1beta	22.7
Secondary CD8 lymphocyte act	0.4	KU-812 (Basophil) rest	0.6
CD4 lymphocyte none	0.2	KU-812 (Basophil) PMA/ionomycin	2.6
2ry Th1/Th2/Tr1_anti-CD95 CH11	0.0	CCD1106 (Keratinocytes) none	27.7
LAK cells rest	0.3	CCD1106 (Keratinocytes) TNFalpha + IL-1beta	4.9
LAK cells IL-2	0.9	Liver cirrhosis	1.1
LAK cells IL-2+IL-12	0.9	Lupus kidney	2.3
LAK cells IL-2+IFN gamma	0.3	NCI-H292 none	48.3
LAK cells IL-2+ IL-18	0.2	NCI-H292 IL-4	57.8
LAK cells PMA/ionomycin	0.7	NCI-H292 IL-9	69.3
NK Cells IL-2 rest	0.7	NCI-H292 IL-13	47.0
Two Way MLR 3 day	0.6	NCI-H292 IFN gamma	42.6
Two Way MLR 5 day	0.4	HPAEC none	13.7
Two Way MLR 7 day	0.7	HPAEC TNF alpha + IL-1 beta	2.1
PBMC rest	1.2	Lung fibroblast none	32.3
PBMC PWM	2.9	Lung fibroblast TNF alpha + IL-1 beta	10.1
PBMC PHA-L	0.7	Lung fibroblast IL-4	31.9
Ramos (B cell) none	0.4	Lung fibroblast IL-9	32.3
Ramos (B cell) ionomycin	1.1	Lung fibroblast IL-13	24.0
B lymphocytes PWM	2.7	Lung fibroblast IFN gamma	37.4
B lymphocytes CD40L and IL-4	0.6	Dermal fibroblast CCD1070 rest	18.2
EOL-1 dbcAMP	1.9	Dermal fibroblast CCD1070 TNF alpha	12.9
EOL-1 dbcAMP PMA/ionomycin	8.6	Dermal fibroblast CCD1070 IL-1 beta	9.9
Dendritic cells none	0.0	Dermal fibroblast IFN gamma	29.9
Dendritic cells LPS	0.1	Dermal fibroblast IL-4	36.1
Dendritic cells anti-CD40	0.8	IBD Colitis 2	1.3
Monocytes rest	0.7	IBD Crohn's	0.8

Monocytes LPS	0.4	Colon	5.4
Macrophages rest	1.3	Lung	5.2
Macrophages LPS	0.3	Thymus	6.7
HUVEC none	11.1	Kidney	2.3
HUVEC starved	15.2		

**Table FF. Panel 5D**

<b>Tissue Name</b>	<b>Rel. Exp.(%) Ag2843, Run 170221175</b>	<b>Tissue Name</b>	<b>Rel. Exp.(%) Ag2843, Run 170221175</b>
97457_Patient-02go_adipose	26.6	94709_Donor 2 AM - A_adipose	19.5
97476_Patient-07sk_skeletal muscle	5.5	94710_Donor 2 AM - B_adipose	10.3
97477_Patient-07ut_uterus	14.0	94711_Donor 2 AM - C_adipose	6.3
97478_Patient-07pl_placenta	17.4	94712_Donor 2 AD - A_adipose	39.5
97481_Patient-08sk_skeletal muscle	4.4	94713_Donor 2 AD - B_adipose	37.1
97482_Patient-08ut_uterus	14.8	94714_Donor 2 AD - C_adipose	28.3
97483_Patient-08pl_placenta	15.3	94742_Donor 3 U - A_Mesenchymal Stem Cells	18.8
97486_Patient-09sk_skeletal muscle	8.4	94743_Donor 3 U - B_Mesenchymal Stem Cells	24.5
97487_Patient-09ut_uterus	9.3	94730_Donor 3 AM - A_adipose	34.4
97488_Patient-09pl_placenta	11.0	94731_Donor 3 AM - B_adipose	18.8
97492_Patient-10ut_uterus	9.7	94732_Donor 3 AM - C_adipose	20.0
97493_Patient-10pl_placenta	24.3	94733_Donor 3 AD - A_adipose	28.5
97495_Patient-11go_adipose	7.5	94734_Donor 3 AD - B_adipose	17.2
97496_Patient-11sk_skeletal muscle	27.4	94735_Donor 3 AD - C_adipose	23.3
97497_Patient-11ut_uterus	27.0	77138_Liver_HepG2untreated	71.7
97498_Patient-11pl_placenta	16.4	73556_Heart_Cardiac stromal cells (primary)	29.5
97500_Patient-12go_adipose	21.5	81735_Small Intestine	4.6
97501_Patient-12sk_skeletal muscle	40.9	72409_Kidney_Proximal Convoluted Tubule	14.9

97502_Patient-12ut_uterus	25.2	82685_Small intestine_Duodenum	1.6
97503_Patient-12pl_placenta	9.2	90650_Adrenal_Adrenocortical adenoma	12.2
94721_Donor 2 U - A_Mesenchymal Stem Cells	26.4	72410_Kidney_HRCE	100.0
94722_Donor 2 U - B_Mesenchymal Stem Cells	21.3	72411_Kidney_HRE	79.0
94723_Donor 2 U - C_Mesenchymal Stem Cells	20.3	73139_Uterus_Uterine smooth muscle cells	22.4

**CNS\_neurodegeneration\_v1.0 Summary:** Ag2843 While no specific association between Alzheimer's disease and the CG55916-01 gene is detected in this panel, these results confirm expression of this gene in the brain. See Panel 1.3D for discussion of utility of this gene in the central nervous system.

- 5 **Panel 1.3D Summary:** Ag2743 Two experiments both show highest expression of the CG55916-01 gene in both fetal and adult skeletal muscle (CTs=27-28). This gene encodes a protein that is homologous to a phosphoinositol-specific (PI) phospholipase. It has moderate expression in a variety of metabolic tissues including pancreas, adrenal, thyroid, pituitary, adult and fetal heart, adult and fetal liver, and adipose. PI-specific phospholipases are
- 10 responsible for the generation of the second messengers diacylglycerol and inositol triphosphate, which promote the activation of protein kinase C and the release of  $Ca^{++}$  from intracellular stores, respectively. Given the myriad roles that these second messengers play in cellular metabolism, it is that selective inhibition of this gene product through the application of a small molecule therapeutic may be useful in the treatment of metabolic disease, including
- 15 Types 1 and 2 diabetes, and obesity.

In addition, all the cancer cell lines on this panel express this gene, suggesting that this gene plays an important role in proliferating cells. There is increased expression in some colon, kidney, lung, breast, ovary, prostate and pancreatic cancer cell lines compared to the normal tissues suggesting that this gene can be used as a marker to differentiate malignant and

20 normal tissue.

Furthermore, expression of this gene in the brain supports abundant literature documenting an important and broad role for PLC in neurons. Dysregulation of PLC in the brain of schizophrenics suggests that specific modulators of this gene product may have utility in damping and thus influencing schizophrenia. Decreased PLC enzymatic activity in



Alzheimer's disease suggests that agents that specifically induce the activity of the protein encoded by this gene may also have utility in treating Alzheimer's disease.

**Panel 2D Summary:** Ag2843 The CG55916-01 gene encodes a putative member of the phospholipase family and is moderately expressed in all tissues on this panel. The highest expression is seen in a kidney cancer sample (CT= 26.8). There are significantly higher level of expression in thyroid, kidney and metastatic breast cancers compared to normal adjacent tissues. These data indicate that the expression of this gene might be associated with these forms of cancer and that therapeutic modulation of this gene using small molecule inhibitors might be of use in the treatment of these cancers.

**Panel 4D Summary:** Ag2843 The CG55916-01 transcript is expressed in most tissues on this panel, but is highly expressed in activated small airway epithelium (CT=25.8). The transcript encodes a putative protein involved in signal transduction. Designing protein therapeutics that inhibit the expression of the transcript or the function of the protein could be important in the treatment of inflammatory diseases, and particularly ones that involve the small airway epithelium such as asthma.

**Panel 5D Summary:** Ag2843 The CG55916-01 gene is moderately expressed in adipose, placenta, and skeletal muscle, results that are consistent with the expression in Panel 1.3D. This gene is also expressed in human mesenchymal stem cells that can be differentiated in vitro into adipocytes, chondrocytes and osteocytes. Thus, this gene product may be a small molecule target for the treatment of disease in bone, cartilage, and adipose.

#### **G. CG55802-01: 3 ALPHA-HYDROXYSTEROID DEHYDROGENASE-LIKE (NOV7)**

Expression of gene CG55802-01 was assessed using the primer-probe set Ag2624, described in Table GA.

**Table GA.** Probe Name Ag2624

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-ttgagttgactccagaggacat-3'	887	293
Probe	TET-5'-attgatggcctcaacagaaatctccg-3'-TAMRA	916	294
Reverse	5'-ccagcaagactgaagaaagaaa-3'	947	295

**CNS\_neurodegeneration\_v1.0 Summary:** Ag2624 Expression of the CG55802-01 gene is low/undetected in all the samples in this panel (CT>35). The amp plot suggests that there is a high probability of a probe failure.

**Panel 1.3D Summary:** Ag2624 Expression of the CG55802-01 gene is low/undetected in all the samples in this panel (CT>35). The amp plot suggests that there is a high probability of a probe failure.

**Panel 4D Summary:** Ag2624 Expression of the CG55802-01 gene is low/undetected in all the samples in this panel (CT>35). The amp plot suggests that there is a high probability of a probe failure.

#### H. CG55906-01: S3-12 (NOV19)

Expression of gene CG55906-01 was assessed using the primer-probe set Ag2840, described in Table HA. Results of the RTQ-PCR runs are shown in Tables HB, HC, HD, HE, HF and HG.

Table HA. Probe Name Ag2840

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-tctatgggtcatgggtacgaaag-3'	1190	296
Probe	TET-5'-acacgatgtccactggggtcacag-3'-TAMRA	1212	297
Reverse	5'-gttgtgttcagcccagtttg-3'	1265	298

Table HB. Panel 1.3D

Tissue Name	Rel. Exp.(%) Ag2840, Run 161922468	Tissue Name	Rel. Exp.(%) Ag2840, Run 161922468
Liver adenocarcinoma	0.5	Kidney (fetal)	1.6
Pancreas	0.3	Renal ca. 786-0	0.1
Pancreatic ca. CAPAN 2	0.2	Renal ca. A498	0.2
Adrenal gland	0.6	Renal ca. RXF 393	0.0
Thyroid	0.8	Renal ca. ACHN	0.0
Salivary gland	0.6	Renal ca. UO-31	0.0
Pituitary gland	0.3	Renal ca. TK-10	0.0
Brain (fetal)	0.0	Liver	0.4
Brain (whole)	0.2	Liver (fetal)	0.9
Brain (amygdala)	0.6	Liver ca. (hepatoblast) HepG2	0.6
Brain (cerebellum)	0.2	Lung	0.3
Brain (hippocampus)	0.6	Lung (fetal)	0.2
Brain (substantia nigra)	0.1	Lung ca. (small cell) LX-1	0.1
Brain (thalamus)	0.2	Lung ca. (small cell) NCI-H69	0.0
Cerebral Cortex	2.1	Lung ca. (s.cell var.) SHP-77	0.1

Spinal cord	0.8	Lung ca. (large cell)NCI-H460	0.0
glio/astro U87-MG	0.0	Lung ca. (non-sm. cell) A549	0.1
glio/astro U-118-MG	0.1	Lung ca. (non-s.cell) NCI-H23	0.0
astrocytoma SW1783	0.1	Lung ca. (non-s.cell) HOP-62	0.0
neuro*; met SK-N-AS	0.0	Lung ca. (non-s.cl) NCI-H522	0.1
astrocytoma SF-539	0.2	Lung ca. (squam.) SW 900	0.1
astrocytoma SNB-75	0.1	Lung ca. (squam.) NCI-H596	0.0
glioma SNB-19	0.0	Mammary gland	18.4
glioma U251	0.1	Breast ca.* (pl.ef) MCF-7	0.1
glioma SF-295	0.2	Breast ca.* (pl.ef) MDA-MB-231	0.0
Heart (fetal)	1.0	Breast ca.* (pl.ef) T47D	0.2
Heart	11.8	Breast ca. BT-549	0.0
Skeletal muscle (fetal)	100.0	Breast ca. MDA-N	0.0
Skeletal muscle	32.8	Ovary	2.9
Bone marrow	0.4	Ovarian ca. OVCAR-3	0.2
Thymus	3.5	Ovarian ca. OVCAR-4	0.1
Spleen	0.4	Ovarian ca. OVCAR-5	0.4
Lymph node	0.7	Ovarian ca. OVCAR-8	0.3
Colorectal	6.7	Ovarian ca. IGROV-1	0.0
Stomach	1.0	Ovarian ca.* (ascites) SK-OV-3	0.0
Small intestine	2.7	Uterus	1.5
Colon ca. SW480	0.0	Placenta	0.0
Colon ca.* SW620(SW480 met)	0.1	Prostate	0.5
Colon ca. HT29	0.4	Prostate ca.* (bone met)PC-3	1.7
Colon ca. HCT-116	0.1	Testis	0.6
Colon ca. CaCo-2	0.0	Melanoma Hs688(A).T	0.0

Colon ca. tissue(ODO3866)	6.4	Melanoma* (met) Hs688(B).T	0.0
Colon ca. HCC-2998	0.1	Melanoma UACC-62	0.0
Gastric ca.* (liver met) NCI-N87	0.8	Melanoma M14	0.0
Bladder	3.3	Melanoma LOX IMVI	0.0
Trachea	3.2	Melanoma* (met) SK-MEL-5	0.0
Kidney	0.9	Adipose	87.1

Table HC. Panel 2D

Tissue Name	Rel. Exp.(%) Ag2840, Run 161922469	Tissue Name	Rel. Exp.(%) Ag2840, Run 161922469
Normal Colon	41.8	Kidney Margin 8120608	0.2
CC Well to Mod Diff (ODO3866)	4.3	Kidney Cancer 8120613	0.7
CC Margin (ODO3866)	6.9	Kidney Margin 8120614	2.0
CC Gr.2 rectosigmoid (ODO3868)	1.1	Kidney Cancer 9010320	8.4
CC Margin (ODO3868)	4.5	Kidney Margin 9010321	2.0
CC Mod Diff (ODO3920)	0.0	Normal Uterus	2.4
CC Margin (ODO3920)	0.0	Uterus Cancer 064011	4.4
CC Gr.2 ascend colon (ODO3921)	0.4	Normal Thyroid	2.3
CC Margin (ODO3921)	2.5	Thyroid Cancer 064010	0.0
CC from Partial Hepatectomy (ODO4309) Mets	0.2	Thyroid Cancer A302152	0.4
Liver Margin (ODO4309)	1.8	Thyroid Margin A302153	0.5
Colon mets to lung (OD04451-01)	0.1	Normal Breast	80.7
Lung Margin (OD04451-02)	0.1	Breast Cancer (OD04566)	1.5
Normal Prostate 6546-1	0.9	Breast Cancer (OD04590-01)	21.0
Prostate Cancer (OD04410)	1.2	Breast Cancer Mets (OD04590-03)	100.0
Prostate Margin (OD04410)	3.2	Breast Cancer Metastasis	13.3

		(OD04655-05)	
Prostate Cancer (OD04720-01)	0.8	Breast Cancer 064006	0.9
Prostate Margin (OD04720-02)	1.9	Breast Cancer 1024	5.8
Normal Lung 061010	1.4	Breast Cancer 9100266	3.2
Lung Met to Muscle (ODO4286)	0.5	Breast Margin 9100265	5.9
Muscle Margin (ODO4286)	16.4	Breast Cancer A209073	2.0
Lung Malignant Cancer (OD03126)	0.1	Breast Margin A2090734	7.9
Lung Margin (OD03126)	0.4	Normal Liver	3.3
Lung Cancer (OD04404)	0.3	Liver Cancer 064003	2.2
Lung Margin (OD04404)	0.3	Liver Cancer 1025	6.0
Lung Cancer (OD04565)	0.0	Liver Cancer 1026	2.0
Lung Margin (OD04565)	0.2	Liver Cancer 6004-T	7.5
Lung Cancer (OD04237-01)	0.0	Liver Tissue 6004-N	2.2
Lung Margin (OD04237-02)	0.1	Liver Cancer 6005-T	1.8
Ocular Mel Met to Liver (ODO4310)	0.4	Liver Tissue 6005-N	0.3
Liver Margin (ODO4310)	2.6	Normal Bladder	6.0
Melanoma Mets to Lung (OD04321)	0.0	Bladder Cancer 1023	0.7
Lung Margin (OD04321)	0.2	Bladder Cancer A302173	0.4
Normal Kidney	3.1	Bladder Cancer (OD04718-01)	0.1
Kidney Ca, Nuclear grade 2 (OD04338)	0.0	Bladder Normal Adjacent (OD04718-03)	11.7
Kidney Margin (OD04338)	0.0	Normal Ovary	0.8
Kidney Ca Nuclear grade 1/2 (OD04339)	0.2	Ovarian Cancer 064008	1.1
Kidney Margin (OD04339)	1.1	Ovarian Cancer (OD04768-07)	0.7
Kidney Ca, Clear cell type (OD04340)	0.3	Ovary Margin (OD04768-08)	2.9
Kidney Margin (OD04340)	1.8	Normal Stomach	15.1
Kidney Ca, Nuclear grade	0.0	Gastric Cancer	6.4

3 (OD04348)		9060358	
Kidney Margin (OD04348)	1.3	Stomach Margin 9060359	2.0
Kidney Cancer (OD04622-01)	0.0	Gastric Cancer 9060395	8.8
Kidney Margin (OD04622-03)	0.0	Stomach Margin 9060394	8.4
Kidney Cancer (OD04450-01)	0.1	Gastric Cancer 9060397	0.9
Kidney Margin (OD04450-03)	1.2	Stomach Margin 9060396	3.1
Kidney Cancer 8120607	0.1	Gastric Cancer 064005	5.3

Table HD. Panel 3D

Tissue Name	Rel. Exp.(%) Ag2840, Run 170190088	Tissue Name	Rel. Exp.(%) Ag2840, Run 170190088
Daoy- Medulloblastoma	22.1	Ca Ski- Cervical epidermoid carcinoma (metastasis)	7.6
TE671- Medulloblastoma	10.1	ES-2- Ovarian clear cell carcinoma	0.0
D283 Med- Medulloblastoma	2.3	Ramos- Stimulated with PMA/ionomycin 6h	0.0
PFSK-1- Primitive Neuroectodermal	6.2	Ramos- Stimulated with PMA/ionomycin 14h	0.0
XF-498- CNS	8.4	MEG-01- Chronic myelogenous leukemia (megokaryoblast)	0.0
SNB-78- Glioma	5.0	Raji- Burkitt's lymphoma	0.0
SF-268- Glioblastoma	1.4	Daudi- Burkitt's lymphoma	0.0
T98G- Glioblastoma	0.0	U266- B-cell plasmacytoma	10.4
SK-N-SH- Neuroblastoma (metastasis)	2.7	CA46- Burkitt's lymphoma	0.0
SF-295- Glioblastoma	2.9	RL- non-Hodgkin's B-cell lymphoma	5.9
Cerebellum	3.4	JM1- pre-B-cell lymphoma	7.8
Cerebellum	38.2	Jurkat- T cell leukemia	2.7
NCI-H292- Mucoepidermoid lung carcinoma	0.0	TF-1- Erythroleukemia	5.0
DMS-114- Small cell lung cancer	0.0	HUT 78- T-cell lymphoma	0.0
DMS-79- Small cell lung cancer	100.0	U937- Histiocytic lymphoma	11.0

NCI-H146- Small cell lung cancer	0.0	KU-812- Myelogenous leukemia	31.0
NCI-H526- Small cell lung cancer	9.6	769-P- Clear cell renal carcinoma	6.1
NCI-N417- Small cell lung cancer	0.0	Caki-2- Clear cell renal carcinoma	3.0
NCI-H82- Small cell lung cancer	3.3	SW 839- Clear cell renal carcinoma	0.0
NCI-H157- Squamous cell lung cancer (metastasis)	0.0	G401- Wilms' tumor	3.7
NCI-H1155- Large cell lung cancer	20.6	Hs766T- Pancreatic carcinoma (LN metastasis)	9.8
NCI-H1299- Large cell lung cancer	9.2	CAPAN-1- Pancreatic adenocarcinoma (liver metastasis)	0.0
NCI-H727- Lung carcinoid	0.0	SU86.86- Pancreatic carcinoma (liver metastasis)	5.0
NCI-UMC-11- Lung carcinoid	0.0	BxPC-3- Pancreatic adenocarcinoma	13.0
LX-1- Small cell lung cancer	7.9	HPAC- Pancreatic adenocarcinoma	20.7
Colo-205- Colon cancer	0.0	MIA PaCa-2- Pancreatic carcinoma	4.2
KM12- Colon cancer	0.0	CFPAC-1- Pancreatic ductal adenocarcinoma	13.9
KM20L2- Colon cancer	2.9	PANC-1- Pancreatic epithelioid ductal carcinoma	69.7
NCI-H716- Colon cancer	0.0	T24- Bladder carcinma (transitional cell)	0.0
SW-48- Colon adenocarcinoma	0.0	5637- Bladder carcinoma	0.0
SW1116- Colon adenocarcinoma	0.0	HT-1197- Bladder carcinoma	6.4
LS 174T- Colon adenocarcinoma	0.0	UM-UC-3- Bladder carcinma (transitional cell)	2.4
SW-948- Colon adenocarcinoma	0.0	A204- Rhabdomyosarcoma	12.5
SW-480- Colon adenocarcinoma	3.8	HT-1080- Fibrosarcoma	12.1
NCI-SNU-5- Gastric carcinoma	2.1	MG-63- Osteosarcoma	0.0
KATO III- Gastric carcinoma	12.0	SK-LMS-1- Leiomyosarcoma (vulva)	16.7
NCI-SNU-16- Gastric carcinoma	5.8	SJRH30- Rhabdomyosarcoma (met to bone marrow)	5.7

NCI-SNU-1- Gastric carcinoma	2.6	A431- Epidermoid carcinoma	0.0
RF-1- Gastric adenocarcinoma	0.0	WM266-4- Melanoma	0.0
RF-48- Gastric adenocarcinoma	7.2	DU 145- Prostate carcinoma (brain metastasis)	0.0
MKN-45- Gastric carcinoma	96.6	MDA-MB-468- Breast adenocarcinoma	11.4
NCI-N87- Gastric carcinoma	10.0	SCC-4- Squamous cell carcinoma of tongue	0.0
OVCAR-5- Ovarian carcinoma	3.7	SCC-9- Squamous cell carcinoma of tongue	0.0
RL95-2- Uterine carcinoma	7.2	SCC-15- Squamous cell carcinoma of tongue	0.0
HelaS3- Cervical adenocarcinoma	0.0	CAL 27- Squamous cell carcinoma of tongue	0.0

Table HE. Panel 4.1D

Tissue Name	Rel. Exp.(%) Ag2840, Run 204964146	Tissue Name	Rel. Exp.(%) Ag2840, Run 204964146
Secondary Th1 act	6.4	HUVEC IL-1beta	0.9
Secondary Th2 act	2.0	HUVEC IFN gamma	4.0
Secondary Tr1 act	4.0	HUVEC TNF alpha + IFN gamma	0.0
Secondary Th1 rest	4.4	HUVEC TNF alpha + IL4	5.4
Secondary Th2 rest	13.9	HUVEC IL-11	3.8
Secondary Tr1 rest	8.2	Lung Microvascular EC none	8.4
Primary Th1 act	3.0	Lung Microvascular EC TNFalpha + IL-1beta	4.0
Primary Th2 act	9.6	Microvascular Dermal EC none	4.5
Primary Tr1 act	1.6	Microvascular Dermal EC TNFalpha + IL-1beta	0.0
Primary Th1 rest	3.2	Bronchial epithelium TNFalpha + IL1beta	10.4
Primary Th2 rest	5.6	Small airway epithelium none	5.9
Primary Tr1 rest	6.4	Small airway epithelium TNFalpha + IL-1beta	8.5
CD45RA CD4 lymphocyte act	6.0	Coronary artery SMC rest	0.0
CD45RO CD4 lymphocyte act	6.2	Coronary artery SMC TNFalpha + IL-1beta	1.0
CD8 lymphocyte act	6.4	Astrocytes rest	0.0



Secondary CD8 lymphocyte rest	2.4	Astrocytes TNFalpha + IL-1beta	1.4
Secondary CD8 lymphocyte act	0.0	KU-812 (Basophil) rest	8.4
CD4 lymphocyte none	12.5	KU-812 (Basophil) PMA/ionomycin	6.1
2ry Th1/Th2/Tr1_anti-CD95 CH11	11.3	CCD1106 (Keratinocytes) none	6.7
LAK cells rest	7.6	CCD1106 (Keratinocytes) TNFalpha + IL-1beta	1.8
LAK cells IL-2	4.2	Liver cirrhosis	63.3
LAK cells IL-2+IL-12	1.9	NCI-H292 none	0.0
LAK cells IL-2+IFN gamma	2.7	NCI-H292 IL-4	0.0
LAK cells IL-2+ IL-18	6.6	NCI-H292 IL-9	0.0
LAK cells PMA/ionomycin	0.0	NCI-H292 IL-13	0.0
NK Cells IL-2 rest	3.4	NCI-H292 IFN gamma	0.0
Two Way MLR 3 day	6.7	HPAEC none	0.0
Two Way MLR 5 day	5.8	HPAEC TNF alpha + IL-1 beta	3.3
Two Way MLR 7 day	8.5	Lung fibroblast none	29.5
PBMC rest	9.3	Lung fibroblast TNF alpha + IL-1 beta	8.2
PBMC PWM	1.0	Lung fibroblast IL-4	7.9
PBMC PHA-L	3.2	Lung fibroblast IL-9	10.3
Ramos (B cell) none	1.9	Lung fibroblast IL-13	4.2
Ramos (B cell) ionomycin	3.0	Lung fibroblast IFN gamma	9.1
B lymphocytes PWM	1.0	Dermal fibroblast CCD1070 rest	2.3
B lymphocytes CD40L and IL-4	9.4	Dermal fibroblast CCD1070 TNF alpha	9.2
EOL-1 dbcAMP	0.8	Dermal fibroblast CCD1070 IL-1 beta	4.9
EOL-1 dbcAMP PMA/ionomycin	6.0	Dermal fibroblast IFN gamma	1.0
Dendritic cells none	0.9	Dermal fibroblast IL-4	8.1
Dendritic cells LPS	0.0	Dermal Fibroblasts rest	4.2
Dendritic cells anti-CD40	3.1	Neutrophils TNFa+LPS	25.0
Monocytes rest	13.8	Neutrophils rest	66.9
Monocytes LPS	4.9	Colon	100.0
Macrophages rest	2.1	Lung	3.8
Macrophages LPS	0.9	Thymus	24.5

HUVEC none	6.3	Kidney	32.1
HUVEC starved	7.9		

Table HF. Panel 4D

Tissue Name	Rel. Exp.(%) Ag2840, Run 159843516	Tissue Name	Rel. Exp.(%) Ag2840, Run 159843516
Secondary Th1 act	2.0	HUVEC IL-1beta	0.2
Secondary Th2 act	1.8	HUVEC IFN gamma	0.9
Secondary Tr1 act	0.5	HUVEC TNF alpha + IFN gamma	0.3
Secondary Th1 rest	1.4	HUVEC TNF alpha + IL4	0.0
Secondary Th2 rest	1.3	HUVEC IL-11	0.0
Secondary Tr1 rest	1.3	Lung Microvascular EC none	1.0
Primary Th1 act	0.5	Lung Microvascular EC TNFalpha + IL-1beta	0.4
Primary Th2 act	1.1	Microvascular Dermal EC none	0.4
Primary Tr1 act	1.0	Microvascular Dermal EC TNFalpha + IL-1beta	0.0
Primary Th1 rest	2.9	Bronchial epithelium TNFalpha + IL1beta	0.2
Primary Th2 rest	1.1	Small airway epithelium none	1.5
Primary Tr1 rest	1.4	Small airway epithelium TNFalpha + IL-1beta	9.2
CD45RA CD4 lymphocyte act	0.5	Coronary artery SMC rest	0.3
CD45RO CD4 lymphocyte act	0.7	Coronary artery SMC TNFalpha + IL-1beta	0.0
CD8 lymphocyte act	0.3	Astrocytes rest	0.3
Secondary CD8 lymphocyte rest	0.6	Astrocytes TNFalpha + IL-1beta	0.0
Secondary CD8 lymphocyte act	0.2	KU-812 (Basophil) rest	1.6
CD4 lymphocyte none	1.5	KU-812 (Basophil) PMA/ionomycin	2.5
2ry Th1/Th2/Tr1_anti- CD95 CH11	1.1	CCD1106 (Keratinocytes) none	0.6
LAK cells rest	1.3	CCD1106 (Keratinocytes) TNFalpha + IL-1beta	0.0
LAK cells IL-2	2.2	Liver cirrhosis	9.6
LAK cells IL-2+IL-12	1.0	Lupus kidney	1.9
LAK cells IL-2+IFN	1.0	NCI-H292 none	0.0

gamma			
LAK cells IL-2+ IL-18	0.7	NCI-H292 IL-4	0.0
LAK cells PMA/ionomycin	0.3	NCI-H292 IL-9	0.0
NK Cells IL-2 rest	1.1	NCI-H292 IL-13	0.0
Two Way MLR 3 day	1.0	NCI-H292 IFN gamma	0.0
Two Way MLR 5 day	0.4	HPAEC none	0.1
Two Way MLR 7 day	0.2	HPAEC TNF alpha + IL-1 beta	0.6
PBMC rest	1.3	Lung fibroblast none	5.0
PBMC PWM	1.2	Lung fibroblast TNF alpha + IL-1 beta	0.8
PBMC PHA-L	1.2	Lung fibroblast IL-4	1.8
Ramos (B cell) none	0.2	Lung fibroblast IL-9	1.8
Ramos (B cell) ionomycin	1.7	Lung fibroblast IL-13	1.2
B lymphocytes PWM	1.6	Lung fibroblast IFN gamma	2.0
B lymphocytes CD40L and IL-4	3.2	Dermal fibroblast CCD1070 rest	1.1
EOL-1 dbcAMP	0.1	Dermal fibroblast CCD1070 TNF alpha	1.7
EOL-1 dbcAMP PMA/ionomycin	1.0	Dermal fibroblast CCD1070 IL-1 beta	0.7
Dendritic cells none	0.0	Dermal fibroblast IFN gamma	0.7
Dendritic cells LPS	0.2	Dermal fibroblast IL-4	0.2
Dendritic cells anti- CD40	0.8	IBD Colitis 2	2.0
Monocytes rest	2.3	IBD Crohn's	8.9
Monocytes LPS	1.2	Colon	100.0
Macrophages rest	1.3	Lung	4.4
Macrophages LPS	0.0	Thymus	16.8
HUVEC none	0.0	Kidney	14.2
HUVEC starved	1.8		

Table HG. Panel 5D

Tissue Name	Rel. Exp.(%) Ag2840, Run 169270970	Tissue Name	Rel. Exp.(%) Ag2840, Run 169270970
97457_Patient- 02go_adipose	63.3	94709_Donor 2 AM - A_adipose	24.1
97476_Patient- 07sk_skeletal muscle	15.8	94710_Donor 2 AM - B_adipose	7.9
97477_Patient-	8.8	94711_Donor 2 AM - C_adipose	4.5

07ut_uterus			
97478_Patient-07pl_placenta	0.0	94712_Donor 2 AD - A_adipose	18.3
97481_Patient-08sk_skeletal muscle	15.7	94713_Donor 2 AD - B_adipose	24.1
97482_Patient-08ut_uterus	8.4	94714_Donor 2 AD - C_adipose	23.5
97483_Patient-08pl_placenta	0.0	94742_Donor 3 U - A_Mesenchymal Stem Cells	0.0
97486_Patient-09sk_skeletal muscle	1.4	94743_Donor 3 U - B_Mesenchymal Stem Cells	0.0
97487_Patient-09ut_uterus	5.5	94730_Donor 3 AM - A_adipose	0.0
97488_Patient-09pl_placenta	0.0	94731_Donor 3 AM - B_adipose	0.0
97492_Patient-10ut_uterus	4.6	94732_Donor 3 AM - C_adipose	0.1
97493_Patient-10pl_placenta	0.3	94733_Donor 3 AD - A_adipose	0.0
97495_Patient-11go_adipose	0.0	94734_Donor 3 AD - B_adipose	0.0
97496_Patient-11sk_skeletal muscle	0.0	94735_Donor 3 AD - C_adipose	0.0
97497_Patient-11ut_uterus	0.0	77138_Liver_HepG2untreated	1.1
97498_Patient-11pl_placenta	0.0	73556_Heart_Cardiac stromal cells (primary)	0.0
97500_Patient-12go_adipose	48.0	81735_Small Intestine	16.8
97501_Patient-12sk_skeletal muscle	100.0	72409_Kidney_Proximal Convoluted Tubule	0.0
97502_Patient-12ut_uterus	18.7	82685_Small intestine_Duodenum	0.7
97503_Patient-12pl_placenta	0.0	90650_Adrenal_Adrenocortical adenoma	0.1
94721_Donor 2 U - A_Mesenchymal Stem Cells	0.0	72410_Kidney_HRCE	0.0
94722_Donor 2 U - B_Mesenchymal Stem Cells	0.2	72411_Kidney_HRE	0.0
94723_Donor 2 U - C_Mesenchymal Stem Cells	0.0	73139_Uterus_Uterine smooth muscle cells	0.2

**Panel 1.3D Summary:** Ag2840 Highest expression of the CG55906-01 gene is seen in fetal and adult skeletal muscle (CTs=26-28) . This gene encodes a putative adipose cell

membrane-associated protein that may be upregulated during adipocyte differentiation. Due to its homology with adipophilins, it is possible that this gene product may be involved in lipid uptake. Inhibiting the action of this gene product with an antibody may therefore potentially reduce white adipose mass by limiting lipid uptake and thereby inhibiting adipose expansion.

- 5 The expression in skeletal muscle may indicate that this gene product can also take up lipids in skeletal muscle. Since excess lipid storage in muscle is associated with insulin resistance, antibody inhibition of this gene product could also be a treatment for the prevention of obesity-associated insulin resistance.

- 10 Furthermore, this gene product is also moderately expressed in a variety of metabolic tissues, including pancreas, adrenal, thyroid, pituitary, adult and fetal heart, and adult and fetal liver. Thus, this gene product may also be an antibody target for the treatment of metabolic disease, including Types 1 and 2 diabetes, and obesity.

- 15 Overall, this gene is expressed at moderate levels in normal tissues but at significantly lower levels in cancer cell lines on this panel. Thus, this gene product may have a role in homeostasis of normal tissue but not in cancer cell lines.

In addition, moderate but significant expression in the cerebral cortex suggests that the protein encoded by this gene plays a role in lipid processing in the brain. LDLR has been implicated in the development of Alzheimer's disease. Therefore, inhibitors of this gene product may have utility in influencing the development of Alzheimer's disease.

- 20 **Panel 2D Summary:** Ag2840 The CG55906-01 gene is moderately expressed in all tissue samples in panel 2. There is increased expression in normal kidney, colon and bladder samples when compared to the corresponding adjacent tumor tissue. This preferential expression in normal tissues is also seen in Panel 1.3D. Thus, expression of this gene could be used to differentiate between normal and cancerous tissues. Furthermore, therapeutic  
25 modulation of the expression of this gene might be of use in the treatment of kidney, colon and bladder cancer.

- 30 **Panel 3D Summary:** Ag2840 The CG55906-01 gene is expressed at a low level in the cancer cell lines on this panel. Significant expression is seen in lung cancer, pancreatic cancer and a leukemia cell line. Thus, the expression of this gene could be used to distinguish samples from these cell lines from other samples on this panel. Furthermore, therapeutic modulation of the expression of this gene might be of use in treating the cancers that are used in the derivation of these cell lines.

**Panel 4.1D Summary:** Ag2840 The CG55906-01 transcript is expressed in colon and in resting neutrophils (CTs=31-33). The colon expression is consistent with panels 4D, 2.2 and 1.3. Thus, the transcript or the protein it encodes could be used to detect colon tissue and neutrophils.

5 **Panel 4D Summary:** Ag2840 The CG55906-01 transcript is expressed in colon and in resting neutrophils. Colon expression is consistent in panel 4D, 2.2 and 1.3. The colon expression is consistent with panels 4D, 2.2 and 1.3. Thus, the transcript or the protein it encodes could be used to detect colon tissue and neutrophils. In addition, the level of expression of this gene is reduced in colon tissue from patients with colitis or Crohn's disease.

10 This suggests that designing therapeutics with the protein encoded for by this transcript could be important for the treatment of IBD.

**Panel 5D Summary:** Ag2840 The CG55906-01 gene is moderately expressed in clinical specimens of adipose, skeletal muscle and uterus. This confirms expression of this gene in tissues with metabolic function. See Panel 1.3D for discussion of utility of this gene in

15 metabolic disease.

#### I. CG55778-01 (NOV16a) and CG55778-05 (NOV16e): Aldose Reductase

Expression of gene CG55778-01 and variant CG55778-05 was assessed using the primer-probe set Ag2599, described in Table IA. Results of the RTQ-PCR runs are shown in Tables IB, IC, and ID.

20 **Table IA.** Probe Name Ag2599

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-gacctgatagacaacctgtga-3'	667	299
Probe	TET-5'-acggcaagtctcctgctcagattttg-3'-TAMRA	710	300
Reverse	5'-atcacattcctctggatttgaa-3'	743	301

**Table IB.** CNS\_neurodegeneration\_v1.0

Tissue Name	Rel. Exp.(%) Ag2599, Run 208779985	Tissue Name	Rel. Exp.(%) Ag2599, Run 208779985
AD 1 Hippo	4.3	Control (Path) 3 Temporal Ctx	9.1
AD 2 Hippo	13.5	Control (Path) 4 Temporal Ctx	35.8
AD 3 Hippo	8.7	AD 1 Occipital Ctx	7.0
AD 4 Hippo	6.8	AD 2 Occipital Ctx (Missing)	0.0
AD 5 hippo	97.3	AD 3 Occipital Ctx	13.9

AD 6 Hippo	27.4	AD 4 Occipital Ctx	16.7
Control 2 Hippo	8.7	AD 5 Occipital Ctx	28.7
Control 4 Hippo	10.8	AD 6 Occipital Ctx	22.7
Control (Path) 3 Hippo	6.6	Control 1 Occipital Ctx	10.7
AD 1 Temporal Ctx	6.4	Control 2 Occipital Ctx	19.8
AD 2 Temporal Ctx	13.1	Control 3 Occipital Ctx	17.4
AD 3 Temporal Ctx	12.5	Control 4 Occipital Ctx	6.3
AD 4 Temporal Ctx	23.8	Control (Path) 1 Occipital Ctx	57.8
AD 5 Inf Temporal Ctx	100.0	Control (Path) 2 Occipital Ctx	4.2
AD 5 Sup Temporal Ctx	51.4	Control (Path) 3 Occipital Ctx	3.5
AD 6 Inf Temporal Ctx	43.8	Control (Path) 4 Occipital Ctx	11.8
AD 6 Sup Temporal Ctx	36.1	Control 1 Parietal Ctx	13.4
Control 1 Temporal Ctx	17.6	Control 2 Parietal Ctx	50.3
Control 2 Temporal Ctx	21.9	Control 3 Parietal Ctx	19.3
Control 3 Temporal Ctx	17.8	Control (Path) 1 Parietal Ctx	73.2
Control 4 Temporal Ctx	11.3	Control (Path) 2 Parietal Ctx	12.6
Control (Path) 1 Temporal Ctx	39.2	Control (Path) 3 Parietal Ctx	5.7
Control (Path) 2 Temporal Ctx	18.7	Control (Path) 4 Parietal Ctx	49.7

Table IC. Panel 1.3D

Tissue Name	Rel. Exp.(%) Ag2599, Run 162292708	Rel. Exp.(%) Ag2599, Run 165645365	Tissue Name	Rel. Exp.(%) Ag2599, Run 162292708	Rel. Exp.(%) Ag2599, Run 165645365
Liver adenocarcinoma	27.5	48.6	Kidney (fetal)	0.9	0.0
Pancreas	0.1	0.0	Renal ca. 786-0	0.0	0.0
Pancreatic ca. CAPAN 2	0.3	2.4	Renal ca. A498	5.3	20.6
Adrenal gland	0.9	1.6	Renal ca. RXF 393	0.0	1.6

Thyroid	1.9	2.0	Renal ca. ACHN	2.6	0.0
Salivary gland	0.4	2.5	Renal ca. UO-31	0.0	0.0
Pituitary gland	1.3	0.0	Renal ca. TK-10	0.0	0.0
Brain (fetal)	0.7	6.3	Liver	0.4	0.0
Brain (whole)	0.5	5.6	Liver (fetal)	0.3	3.7
Brain (amygdala)	0.3	11.3	Liver ca. (hepatoblast) HepG2	0.0	0.0
Brain (cerebellum)	0.7	3.4	Lung	1.6	3.1
Brain (hippocampus)	2.0	11.3	Lung (fetal)	0.8	2.9
Brain (substantia nigra)	0.1	4.3	Lung ca. (small cell) LX-1	12.7	64.2
Brain (thalamus)	0.4	5.3	Lung ca. (small cell) NCI-H69	7.6	27.4
Cerebral Cortex	83.5	66.4	Lung ca. (s.cell var.) SHP-77	4.8	11.7
Spinal cord	1.2	0.0	Lung ca. (large cell) NCI-H460	0.0	0.0
glio/astro U87-MG	0.5	0.0	Lung ca. (non-sm. cell) A549	14.1	37.4
glio/astro U-118-MG	0.0	0.0	Lung ca. (non-s.cell) NCI-H23	1.0	0.0
astrocytoma SW1783	5.2	3.0	Lung ca. (non-s.cell) HOP-62	4.5	22.2
neuro*; met SK-N-AS	0.6	1.7	Lung ca. (non-s.cl) NCI-H522	20.9	39.2
astrocytoma SF-539	0.0	0.0	Lung ca. (squam.) SW 900	1.0	5.9
astrocytoma SNB-75	0.0	8.8	Lung ca. (squam.) NCI-H596	1.3	5.4
glioma SNB-19	0.0	0.0	Mammary gland	4.2	5.6
glioma U251	0.0	0.0	Breast ca.* (pl.ef) MCF-7	16.4	36.1
glioma SF-295	0.0	0.0	Breast ca.* (pl.ef) MDA-	3.3	34.4



			MB-231		
Heart (fetal)	100.0	97.3	Breast ca.* (pl.ef) T47D	4.1	2.2
Heart	1.8	10.7	Breast ca. BT-549	1.0	17.1
Skeletal muscle (fetal)	95.3	28.3	Breast ca. MDA-N	0.0	0.0
Skeletal muscle	1.9	22.1	Ovary	29.5	23.0
Bone marrow	0.0	8.4	Ovarian ca. OVCAR-3	0.8	1.8
Thymus	2.5	0.0	Ovarian ca. OVCAR-4	1.0	8.2
Spleen	1.1	1.7	Ovarian ca. OVCAR-5	6.0	13.5
Lymph node	0.0	12.2	Ovarian ca. OVCAR-8	1.9	16.4
Colorectal	10.6	4.8	Ovarian ca. IGROV-1	0.0	0.0
Stomach	0.4	11.3	Ovarian ca.* (ascites) SK-OV-3	0.5	0.0
Small intestine	0.7	6.3	Uterus	1.5	22.5
Colon ca. SW480	3.3	18.7	Placenta	0.7	3.4
Colon ca.* SW620(SW480 met)	4.2	4.8	Prostate	0.8	1.7
Colon ca. HT29	1.2	3.1	Prostate ca.* (bone met)PC-3	0.0	0.5
Colon ca. HCT-116	1.4	1.3	Testis	35.4	100.0
Colon ca. CaCo-2	42.9	23.5	Melanoma Hs688(A).T	5.0	2.0
Colon ca. tissue(ODO3866)	10.6	21.5	Melanoma* (met) Hs688(B).T	2.1	11.7
Colon ca. HCC-2998	3.2	17.9	Melanoma UACC-62	10.3	47.0
Gastric ca.* (liver met) NCI-N87	0.0	0.0	Melanoma M14	5.6	48.6
Bladder	6.0	2.3	Melanoma LOX IMVI	3.0	1.1
Trachea	0.8	4.2	Melanoma* (met) SK-MEL-5	2.0	3.2
Kidney	0.6	0.0	Adipose	4.7	12.3

Table ID. Panel 2D

Tissue Name	Rel. Exp.(%) Ag2599, Run 161921329	Tissue Name	Rel. Exp.(%) Ag2599, Run 161921329
Normal Colon	21.3	Kidney Margin 8120608	16.2
CC Well to Mod Diff (ODO3866)	8.4	Kidney Cancer 8120613	3.6
CC Margin (ODO3866)	6.2	Kidney Margin 8120614	9.1
CC Gr.2 rectosigmoid (ODO3868)	6.3	Kidney Cancer 9010320	6.1
CC Margin (ODO3868)	4.7	Kidney Margin 9010321	21.8
CC Mod Diff (ODO3920)	8.4	Normal Uterus	6.3
CC Margin (ODO3920)	7.9	Uterus Cancer 064011	24.5
CC Gr.2 ascend colon (ODO3921)	48.6	Normal Thyroid	1.3
CC Margin (ODO3921)	8.1	Thyroid Cancer 064010	0.3
CC from Partial Hepatectomy (ODO4309) Mets	28.7	Thyroid Cancer A302152	1.7
Liver Margin (ODO4309)	6.0	Thyroid Margin A302153	15.9
Colon mets to lung (OD04451-01)	2.8	Normal Breast	18.4
Lung Margin (OD04451- 02)	5.1	Breast Cancer (OD04566)	3.0
Normal Prostate 6546-1	0.0	Breast Cancer (OD04590-01)	14.5
Prostate Cancer (OD04410)	3.1	Breast Cancer Mets (OD04590-03)	21.2
Prostate Margin (OD04410)	9.2	Breast Cancer Metastasis (OD04655-05)	1.9
Prostate Cancer (OD04720-01)	11.2	Breast Cancer 064006	7.7
Prostate Margin (OD04720-02)	16.6	Breast Cancer 1024	46.7
Normal Lung 061010	22.5	Breast Cancer 9100266	5.8
Lung Met to Muscle (ODO4286)	54.0	Breast Margin 9100265	5.3
Muscle Margin	24.7	Breast Cancer	35.4

(ODO4286)		A209073	
Lung Malignant Cancer (OD03126)	20.7	Breast Margin A2090734	13.8
Lung Margin (OD03126)	12.4	Normal Liver	1.3
Lung Cancer (OD04404)	18.2	Liver Cancer 064003	0.6
Lung Margin (OD04404)	7.9	Liver Cancer 1025	1.5
Lung Cancer (OD04565)	6.8	Liver Cancer 1026	4.1
Lung Margin (OD04565)	5.7	Liver Cancer 6004-T	3.1
Lung Cancer (OD04237-01)	0.5	Liver Tissue 6004-N	1.4
Lung Margin (OD04237-02)	7.4	Liver Cancer 6005-T	3.6
Ocular Mel Met to Liver (ODO4310)	7.5	Liver Tissue 6005-N	0.6
Liver Margin (ODO4310)	6.6	Normal Bladder	5.3
Melanoma Mets to Lung (OD04321)	0.0	Bladder Cancer 1023	13.0
Lung Margin (OD04321)	12.2	Bladder Cancer A302173	6.8
Normal Kidney	18.4	Bladder Cancer (OD04718-01)	2.1
Kidney Ca, Nuclear grade 2 (OD04338)	11.3	Bladder Normal Adjacent (OD04718-03)	24.5
Kidney Margin (OD04338)	13.7	Normal Ovary	12.4
Kidney Ca Nuclear grade 1/2 (OD04339)	1.6	Ovarian Cancer 064008	<b>100.0</b>
Kidney Margin (OD04339)	8.0	Ovarian Cancer (OD04768-07)	96.6
Kidney Ca, Clear cell type (OD04340)	5.5	Ovary Margin (OD04768-08)	11.5
Kidney Margin (OD04340)	8.5	Normal Stomach	10.2
Kidney Ca, Nuclear grade 3 (OD04348)	1.0	Gastric Cancer 9060358	3.4
Kidney Margin (OD04348)	4.6	Stomach Margin 9060359	7.0
Kidney Cancer (OD04622-01)	3.2	Gastric Cancer 9060395	5.1
Kidney Margin (OD04622-03)	3.4	Stomach Margin 9060394	6.2
Kidney Cancer (OD04450-01)	1.4	Gastric Cancer 9060397	3.6
Kidney Margin	8.4	Stomach Margin	2.5

(OD04450-03)		9060396	
Kidney Cancer 8120607	3.7	Gastric Cancer 064005	7.4

**CNS\_neurodegeneration\_v1.0 Summary:** Ag2599 This panel confirms expression of the CG55778-01 gene in the central nervous system. Please see Panel 1.3D for discussion of utility of this gene in the central nervous system.

**Panel 1.3D Summary:** Ag2599 The CG55778-01 gene is most highly expressed (CT values = 29-34) in the fetal heart and the testis (CT=29-31) in two runs with the same probe and primer set. This gene product appears to be differentially expressed in fetal (CT values = 29-31) vs adult heart (CT values = 34-35), and may be useful for the differentiation of the adult from the fetal phenotype in this tissue. Furthermore, the higher levels of expression in fetal heart suggest that this gene product may be involved in the development and homeostasis of this organ. Therapeutic modulation of the expression or function of this gene may be useful in the treatment of diseases that affect the heart, including cardiomyopathy, atherosclerosis, hypertension, and congenital heart defects.

This gene is also expressed in other metabolic tissues, including adult and fetal skeletal muscle and adipose.

Aldose reductase inhibitors prevent peripheral nerve dysfunction and morphological abnormalities in diabetic animal models. Therefore, this gene product may be a small molecule drug target for the prevention of morbidity associated with Types 1 and 2 diabetes in humans.

There also appears to be clusters of expression of this gene in liver adenocarcinoma, melanoma and lung cancer cell lines. This data indicate that the expression of this gene might be associated with these forms of cancer and thus, therapeutic modulation of this gene might be of use in the treatment of these cancer.

Because aldose reductase inhibitors prevent nerve degeneration in the periphery, the cerebral cortex-preferential expression of this gene product in the adult suggests that inhibitors of the protein encoded by this gene may have utility in treating neurodegenerative diseases involving the cerebral cortex, such as Alzheimer's disease, Huntington's disease, depression and possibly even schizophrenia. Furthermore, vascular permeability is a known pathological feature of Alzheimer's disease. Because aldose reductase inhibitors prevent increased vascular permeability associated with disease, inhibitors of this gene product may also have utility in treating Alzheimer's disease by specifically addressing associated vascular pathology in the cerebral cortex.

**Panel 2D Summary:** Ag2599 The CG55778-01 gene is expressed at a higher level in ovarian and breast cancers compared to normal adjacent tissue (CTs=27-29). There also appears to be higher expression in normal thyroid and kidney tissues compared to the adjacent tumors. Thus, the expression of this gene could be used to distinguish malignant ovary, breast, thyroid and kidney tissue from normal tissue in these organs. In addition, therapeutic modulation of this gene might be of use in the treatment of ovarian and breast cancer.

#### J. CG55904-01: SQUALENE DESATURASE (NOV8)

Expression of gene CG55904-01 was assessed using the primer-probe set Ag2834, described in Table JA.

10 **Table JA.** Probe Name Ag2834

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-ggtagggtactgtcgggtgaattg-3'	380	302
Probe	TET-5'-cttcattcaaatgaaaataatttcgagcaag-3'-TAMRA	418	303
Reverse	5'-gcaatcgcagcttcttcag-3'	448	304

**CNS\_neurodegeneration\_v1.0 Summary:** Ag2834 Expression of the CG55904-01 gene is low/undetectable in all samples in this panel (CTs>35).

**Panel 1.3D Summary:** Ag2834 Expression of the CG55904-01 gene is low/undetectable in all samples in this panel (CTs>35).

15 **Panel 2D Summary:** Ag2834 Expression of the CG55904-01 gene is low/undetectable in all samples in this panel (CTs>35).

**Panel 3D Summary:** Ag2834 Expression of the CG55904-01 gene is low/undetectable in all samples in this panel (CTs>35).

20 **Panel 4D Summary:** Ag2834 Expression of the CG55904-01 gene is low/undetectable in all samples in this panel (CTs>35).

#### K. CG55920-01 (NOV12a) and CG55920-04 (NOV12b): KILON PROTEIN PRECURSOR

25 Expression of gene CG55920-01 and variant CG55920-04 was assessed using the primer-probe sets Ag2847 and Ag2880, described in Tables KA and KB. Results of the RTQ-PCR runs are shown in Tables KC, KD, KE, KF and KG.

**Table KA.** Probe Name Ag2847

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-agggactacagcctccagatac-3'	388	305
Probe	TET-5'-atggcccatatacagtggttctgttcag-3'-TAMRA	431	306
Reverse	5'-cattgttctgggtgtatgttga-3'	459	307

**Table KB. Probe Name Ag2880**

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-gctgggtaccttgtgttgacact-3'	1088	308
Probe	TET-5'-ccagcatattctacctgaagaatgccca-3'-TAMRA	1121	309
Reverse	5'-aaagccttttatgggtccttga-3'	1161	310

**Table KC. CNS\_neurodegeneration\_v1.0**

Tissue Name	Rel. Exp.(%) Ag2847, Run 208699894	Rel. Exp.(%) Ag2880, Run 209058910	Tissue Name	Rel. Exp.(%) Ag2847, Run 208699894	Rel. Exp.(%) Ag2880, Run 209058910
AD 1 Hippo	5.6	2.4	Control (Path) 3 Temporal Ctx	1.9	0.3
AD 2 Hippo	13.9	10.5	Control (Path) 4 Temporal Ctx	29.3	12.8
AD 3 Hippo	2.7	1.1	AD 1 Occipital Ctx	11.0	4.6
AD 4 Hippo	3.1	0.5	AD 2 Occipital Ctx (Missing)	0.0	0.0
AD 5 Hippo	84.1	100.0	AD 3 Occipital Ctx	1.9	1.0
AD 6 Hippo	19.9	19.8	AD 4 Occipital Ctx	12.2	2.7
Control 2 Hippo	15.5	12.9	AD 5 Occipital Ctx	39.0	18.9
Control 4 Hippo	2.1	1.4	AD 6 Occipital Ctx	24.0	46.7
Control (Path) 3 Hippo	1.3	0.4	Control 1 Occipital Ctx	0.7	0.3
AD 1 Temporal	4.6	2.0	Control 2 Occipital	50.3	66.4

Ctx			Ctx		
AD 2 Temporal Ctx	22.8	13.9	Control 3 Occipital Ctx	12.6	3.9
AD 3 Temporal Ctx	2.1	0.7	Control 4 Occipital Ctx	1.6	1.0
AD 4 Temporal Ctx	15.0	4.0	Control (Path) 1 Occipital Ctx	69.3	93.3
AD 5 Inf Temporal Ctx	<b>100.0</b>	81.8	Control (Path) 2 Occipital Ctx	9.8	3.6
AD 5 Sup Temporal Ctx	20.3	16.6	Control (Path) 3 Occipital Ctx	0.6	0.3
AD 6 Inf Temporal Ctx	24.3	28.7	Control (Path) 4 Occipital Ctx	11.2	4.7
AD 6 Sup Temporal Ctx	24.5	29.3	Control 1 Parietal Ctx	2.5	0.6
Control 1 Temporal Ctx	1.6	0.4	Control 2 Parietal Ctx	19.3	13.3
Control 2 Temporal Ctx	30.1	35.6	Control 3 Parietal Ctx	12.6	4.9
Control 3 Temporal Ctx	7.3	2.6	Control (Path) 1 Parietal Ctx	62.9	92.7
Control 3 Temporal Ctx	2.6	1.3	Control (Path) 2 Parietal Ctx	15.5	9.5
Control (Path) 1 Temporal Ctx	44.1	54.7	Control (Path) 3 Parietal Ctx	1.2	0.3
Control (Path) 2 Temporal Ctx	22.7	15.7	Control (Path) 4 Parietal Ctx	40.1	27.0

Table KD. Panel 1.3D

Tissue Name	Rel. Exp.(%) Ag2847, Run 161930455	Rel. Exp.(%) Ag2880, Run 159996472	Tissue Name	Rel. Exp.(%) Ag2847, Run 161930455	Rel. Exp.(%) Ag2880, Run 159996472
Liver adenocarcinoma	1.2	0.3	Kidney (fetal)	0.9	1.3
Pancreas	0.5	0.5	Renal ca. 786- 0	0.2	0.3
Pancreatic ca. CAPAN 2	0.0	0.0	Renal ca. A498	0.5	0.5
Adrenal gland	1.1	1.8	Renal ca. RXF 393	0.0	0.0
Thyroid	1.4	1.4	Renal ca. ACHN	0.5	0.3
Salivary gland	0.3	0.3	Renal ca. UO- 31	4.3	4.1
Pituitary gland	2.6	6.0	Renal ca. TK- 10	0.0	0.1
Brain (fetal)	4.8	8.7	Liver	0.0	0.1
Brain (whole)	19.8	21.5	Liver (fetal)	0.1	0.1
Brain (amygdala)	20.9	31.9	Liver ca. (hepatoblast) HepG2	0.0	0.0
Brain (cerebellum)	25.0	15.2	Lung	2.2	4.2
Brain (hippocampus)	38.4	100.0	Lung (fetal)	1.2	0.4
Brain (substantia nigra)	3.6	4.0	Lung ca. (small cell) LX-1	0.0	0.0
Brain (thalamus)	5.9	9.2	Lung ca. (small cell) NCI-H69	0.3	0.6
Cerebral Cortex	100.0	40.3	Lung ca. (s.cell var.) SHP-77	1.6	1.3
Spinal cord	11.1	2.7	Lung ca. (large cell)NCI-H460	0.2	0.1
glio/astro U87-MG	1.3	0.3	Lung ca. (non- sm. cell) A549	0.0	0.0
glio/astro U-118- MG	9.7	20.7	Lung ca. (non- s.cell) NCI- H23	0.1	0.0
astrocytoma SW1783	2.9	1.5	Lung ca. (non- s.cell) HOP-62	2.0	1.3
neuro*; met SK-N- AS	0.5	2.4	Lung ca. (non- s.cl) NCI- H522	0.1	0.0



astrocytoma SF-539	0.8	0.4	Lung ca. (squam.) SW 900	0.0	0.0
astrocytoma SNB-75	0.2	0.1	Lung ca. (squam.) NCI-H596	0.3	0.2
glioma SNB-19	0.2	0.2	Mammary gland	1.4	3.8
glioma U251	0.8	0.4	Breast ca.* (pl.ef) MCF-7	0.0	0.0
glioma SF-295	0.0	0.0	Breast ca.* (pl.ef) MDA-MB-231	0.7	3.8
Heart (fetal)	5.4	1.0	Breast ca.* (pl.ef) T47D	0.0	0.0
Heart	4.7	1.9	Breast ca. BT-549	0.2	2.0
Skeletal muscle (fetal)	22.7	6.8	Breast ca. MDA-N	0.0	0.0
Skeletal muscle	3.8	0.6	Ovary	5.2	1.4
Bone marrow	0.3	0.6	Ovarian ca. OVCAR-3	0.9	1.0
Thymus	8.2	1.3	Ovarian ca. OVCAR-4	0.0	0.0
Spleen	0.1	0.1	Ovarian ca. OVCAR-5	0.0	0.0
Lymph node	0.7	0.6	Ovarian ca. OVCAR-8	1.3	1.1
Colorectal	9.0	1.7	Ovarian ca. IGROV-1	0.0	0.0
Stomach	2.2	4.0	Ovarian ca.* (ascites) SK-OV-3	0.0	0.3
Small intestine	5.6	7.1	Uterus	2.2	2.5
Colon ca. SW480	0.0	0.0	Placenta	0.5	0.6
Colon ca.* SW620(SW480 met)	0.0	0.0	Prostate	0.7	0.3
Colon ca. HT29	0.0	0.0	Prostate ca.* (bone met)PC-3	1.4	1.7
Colon ca. HCT-116	0.0	0.0	Testis	1.7	1.2
Colon ca. CaCo-2	0.0	0.0	Melanoma Hs688(A).T	5.4	2.4
Colon ca.	2.5	0.9	Melanoma*	5.5	2.3

tissue(ODO3866)			(met) Hs688(B).T		
Colon ca. HCC-2998	0.0	0.0	Melanoma UACC-62	0.0	0.0
Gastric ca.* (liver met) NCI-N87	0.0	0.4	Melanoma M14	0.0	0.4
Bladder	3.3	0.3	Melanoma LOX IMVI	0.0	0.1
Trachea	3.9	4.0	Melanoma* (met) SK-MEL-5	0.1	0.0
Kidney	2.3	0.4	Adipose	8.6	3.2

Table KE. Panel 2D

Tissue Name	Rel. Exp.(%) Ag2847, Run 161930456	Rel. Exp.(%) Ag2880, Run 159996526	Tissue Name	Rel. Exp.(%) Ag2847, Run 161930456	Rel. Exp.(%) Ag2880, Run 159996526
Normal Colon	100.0	100.0	Kidney Margin 8120608	7.2	2.3
CC Well to Mod Diff (ODO3866)	2.4	4.2	Kidney Cancer 8120613	0.0	0.0
CC Margin (ODO3866)	19.1	26.6	Kidney Margin 8120614	10.7	3.0
CC Gr.2 rectosigmoid (ODO3868)	2.7	3.4	Kidney Cancer 9010320	1.3	0.7
CC Margin (ODO3868)	15.4	17.2	Kidney Margin 9010321	9.6	5.1
CC Mod Diff (ODO3920)	1.6	0.7	Normal Uterus	17.9	12.9
CC Margin (ODO3920)	29.5	23.0	Uterus Cancer 064011	43.2	22.7
CC Gr.2 ascend colon (ODO3921)	17.6	17.9	Normal Thyroid	7.4	12.6
CC Margin (ODO3921)	18.2	22.4	Thyroid Cancer 064010	2.0	1.0
CC from Partial Hepatectomy (ODO4309) Mets	0.3	1.0	Thyroid Cancer A302152	1.2	1.8
Liver Margin (ODO4309)	0.1	1.1	Thyroid Margin	16.0	17.6

			A302153		
Colon mets to lung (OD04451-01)	2.0	0.8	Normal Breast	16.7	13.2
Lung Margin (OD04451-02)	3.8	4.3	Breast Cancer (OD04566)	22.5	11.2
Normal Prostate 6546-1	1.8	3.9	Breast Cancer (OD04590-01)	9.2	8.9
Prostate Cancer (OD04410)	14.3	19.3	Breast Cancer Mets (OD04590-03)	26.4	20.6
Prostate Margin (OD04410)	19.9	16.7	Breast Cancer Metastasis (OD04655-05)	2.9	4.6
Prostate Cancer (OD04720-01)	17.2	17.4	Breast Cancer 064006	5.3	8.4
Prostate Margin (OD04720-02)	22.2	29.1	Breast Cancer 1024	8.5	6.7
Normal Lung 061010	35.4	43.2	Breast Cancer 9100266	7.9	8.7
Lung Met to Muscle (ODO4286)	14.2	13.0	Breast Margin 9100265	7.9	5.6
Muscle Margin (ODO4286)	17.9	12.8	Breast Cancer A209073	10.9	13.7
Lung Malignant Cancer (OD03126)	6.6	7.5	Breast Margin A2090734	2.5	4.1
Lung Margin (OD03126)	10.3	10.2	Normal Liver	0.7	0.7
Lung Cancer (OD04404)	2.6	3.4	Liver Cancer 064003	0.1	0.2
Lung Margin (OD04404)	12.9	12.2	Liver Cancer 1025	0.3	0.1
Lung Cancer (OD04565)	0.9	2.0	Liver Cancer 1026	0.2	0.1
Lung Margin (OD04565)	4.0	2.1	Liver Cancer 6004-T	0.1	0.1
Lung Cancer (OD04237-01)	2.7	3.7	Liver Tissue 6004-N	0.2	0.3
Lung Margin (OD04237-02)	17.6	16.8	Liver Cancer 6005-T	0.5	0.2
Ocular Mel Met to Liver (ODO4310)	0.1	0.3	Liver Tissue 6005-N	0.1	0.0
Liver Margin (ODO4310)	0.2	0.0	Normal Bladder	10.1	17.1

Melanoma Mets to Lung (OD04321)	7.8	7.2	Bladder Cancer 1023	1.8	1.3
Lung Margin (OD04321)	31.0	23.5	Bladder Cancer A302173	3.9	5.4
Normal Kidney	41.8	58.2	Bladder Cancer (OD04718-01)	4.4	2.2
Kidney Ca, Nuclear grade 2 (OD04338)	3.4	7.9	Bladder Normal Adjacent (OD04718-03)	97.9	88.3
Kidney Margin (OD04338)	22.4	14.3	Normal Ovary	7.2	4.0
Kidney Ca Nuclear grade 1/2 (OD04339)	0.7	3.5	Ovarian Cancer 064008	14.0	14.8
Kidney Margin (OD04339)	17.3	15.3	Ovarian Cancer (OD04768-07)	0.1	0.4
Kidney Ca, Clear cell type (OD04340)	1.3	4.0	Ovary Margin (OD04768-08)	6.4	7.6
Kidney Margin (OD04340)	35.4	40.1	Normal Stomach	40.6	46.3
Kidney Ca, Nuclear grade 3 (OD04348)	0.6	0.2	Gastric Cancer 9060358	10.8	9.0
Kidney Margin (OD04348)	10.0	11.2	Stomach Margin 9060359	9.8	11.3
Kidney Cancer (OD04622-01)	2.0	0.9	Gastric Cancer 9060395	26.6	36.1
Kidney Margin (OD04622-03)	2.4	3.1	Stomach Margin 9060394	14.2	14.7
Kidney Cancer (OD04450-01)	0.0	2.1	Gastric Cancer 9060397	7.5	7.9
Kidney Margin (OD04450-03)	19.8	13.0	Stomach Margin 9060396	5.1	3.8
Kidney Cancer 8120607	2.0	1.5	Gastric Cancer 064005	21.0	22.4

Table KF. Panel 4D

Tissue Name	Rel. Exp.(%)	Tissue Name	Rel. Exp.(%)
-------------	--------------	-------------	--------------

	Ag2880, Run 159996551		Ag2880, Run 159996551
Secondary Th1 act	0.2	HUVEC IL-1beta	16.0
Secondary Th2 act	0.0	HUVEC IFN gamma	17.8
Secondary Tr1 act	0.0	HUVEC TNF alpha + IFN gamma	13.9
Secondary Th1 rest	0.0	HUVEC TNF alpha + IL4	15.8
Secondary Th2 rest	0.0	HUVEC IL-11	5.3
Secondary Tr1 rest	0.0	Lung Microvascular EC none	6.6
Primary Th1 act	0.0	Lung Microvascular EC TNFalpha + IL-1beta	12.1
Primary Th2 act	0.6	Microvascular Dermal EC none	4.6
Primary Tr1 act	1.2	Microvascular Dermal EC TNFalpha + IL-1beta	1.3
Primary Th1 rest	0.6	Bronchial epithelium TNFalpha + IL1beta	2.7
Primary Th2 rest	0.4	Small airway epithelium none	0.7
Primary Tr1 rest	0.0	Small airway epithelium TNFalpha + IL-1beta	1.6
CD45RA CD4 lymphocyte act	21.5	Coronary artery SMC rest	53.2
CD45RO CD4 lymphocyte act	0.7	Coronary artery SMC TNFalpha + IL-1beta	27.5
CD8 lymphocyte act	0.2	Astrocytes rest	5.7
Secondary CD8 lymphocyte rest	0.5	Astrocytes TNFalpha + IL-1beta	5.8
Secondary CD8 lymphocyte act	0.0	KU-812 (Basophil) rest	0.7
CD4 lymphocyte none	0.0	KU-812 (Basophil) PMA/ionomycin	0.5
2ry Th1/Th2/Tr1_anti- CD95 CH11	0.0	CCD1106 (Keratinocytes) none	0.0
LAK cells rest	0.0	CCD1106 (Keratinocytes) TNFalpha + IL-1beta	0.0
LAK cells IL-2	0.3	Liver cirrhosis	1.3
LAK cells IL-2+IL-12	0.2	Lupus kidney	3.5
LAK cells IL-2+IFN gamma	0.2	NCI-H292 none	2.4
LAK cells IL-2+ IL-18	0.2	NCI-H292 IL-4	7.5
LAK cells PMA/ionomycin	0.0	NCI-H292 IL-9	9.3
NK Cells IL-2 rest	0.0	NCI-H292 IL-13	3.5

Two Way MLR 3 day	0.7	NCI-H292 IFN gamma	2.4
Two Way MLR 5 day	0.4	HPAEC none	16.5
Two Way MLR 7 day	0.1	HPAEC TNF alpha + IL-1 beta	17.4
PBMC rest	0.0	Lung fibroblast none	7.3
PBMC PWM	0.1	Lung fibroblast TNF alpha + IL-1 beta	3.2
PBMC PHA-L	0.0	Lung fibroblast IL-4	14.6
Ramos (B cell) none	7.0	Lung fibroblast IL-9	15.3
Ramos (B cell) ionomycin	100.0	Lung fibroblast IL-13	8.4
B lymphocytes PWM	0.4	Lung fibroblast IFN gamma	15.2
B lymphocytes CD40L and IL-4	0.8	Dermal fibroblast CCD1070 rest	89.5
EOL-1 dbcAMP	0.0	Dermal fibroblast CCD1070 TNF alpha	88.3
EOL-1 dbcAMP PMA/ionomycin	0.2	Dermal fibroblast CCD1070 IL-1 beta	51.4
Dendritic cells none	0.0	Dermal fibroblast IFN gamma	20.7
Dendritic cells LPS	0.1	Dermal fibroblast IL-4	35.6
Dendritic cells anti-CD40	0.6	IBD Colitis 2	5.0
Monocytes rest	1.7	IBD Crohn's	6.1
Monocytes LPS	0.0	Colon	42.0
Macrophages rest	0.0	Lung	16.5
Macrophages LPS	0.0	Thymus	44.4
HUVEC none	33.7	Kidney	19.2
HUVEC starved	70.7		

Table KG. Panel CNS\_1

Tissue Name	Rel. Exp.(%) Ag2847, Run 171669934	Rel. Exp.(%) Ag2880, Run 171688447	Tissue Name	Rel. Exp.(%) Ag2847, Run 171669934	Rel. Exp.(%) Ag2880, Run 171688447
BA4 Control	31.2	13.0	BA17 PSP	34.2	8.7
BA4 Control2	61.6	58.6	BA17 PSP2	9.6	2.6
BA4 Alzheimer's2	6.1	0.7	Sub Nigra Control	12.2	5.3
BA4 Parkinson's	36.6	15.9	Sub Nigra Control2	19.6	19.6
BA4 Parkinson's2	68.8	60.3	Sub Nigra Alzheimer's2	5.9	1.2
BA4 Huntington's	31.6	30.1	Sub Nigra Parkinson's2	24.0	17.7

BA4 Huntington's2	4.6	0.0	Sub Nigra Huntington's	31.9	14.6
BA4 PSP	7.7	1.1	Sub Nigra Huntington's2	11.2	7.3
BA4 PSP2	27.7	9.7	Sub Nigra PSP2	6.0	2.5
BA4 Depression	14.5	6.3	Sub Nigra Depression	2.5	3.2
BA4 Depression2	8.3	0.0	Sub Nigra Depression2	3.7	1.2
BA7 Control	53.2	23.3	Glob Palladus Control	5.1	2.6
BA7 Control2	33.7	25.3	Glob Palladus Control2	6.1	2.5
BA7 Alzheimer's2	11.6	2.3	Glob Palladus Alzheimer's	4.5	2.1
BA7 Parkinson's	16.6	5.3	Glob Palladus Alzheimer's2	1.7	1.1
BA7 Parkinson's2	51.4	45.1	Glob Palladus Parkinson's	36.6	25.5
BA7 Huntington's	42.3	22.8	Glob Palladus Parkinson's2	5.3	1.2
BA7 Huntington's2	50.7	14.0	Glob Palladus PSP	1.7	0.6
BA7 PSP	43.8	21.8	Glob Palladus PSP2	3.9	0.0
BA7 PSP2	36.3	19.5	Glob Palladus Depression	2.0	0.4
BA7 Depression	12.7	1.2	Temp Pole Control	17.1	9.3
BA9 Control	25.0	9.7	Temp Pole Control2	69.7	57.8
BA9 Control2	<b>100.0</b>	<b>100.0</b>	Temp Pole Alzheimer's	7.9	0.3
BA9 Alzheimer's	8.1	1.1	Temp Pole Alzheimer's2	5.3	1.3
BA9 Alzheimer's2	18.3	3.5	Temp Pole Parkinson's	30.6	13.6
BA9 Parkinson's	37.1	13.5	Temp Pole Parkinson's2	29.3	11.3
BA9 Parkinson's2	63.3	55.1	Temp Pole Huntington's	43.2	18.3
BA9 Huntington's	55.1	32.3	Temp Pole PSP	7.0	0.5
BA9 Huntington's2	12.2	0.9	Temp Pole PSP2	8.6	0.5

BA9 PSP	15.2	4.3	Temp Pole Depression2	4.5	0.7
BA9 PSP2	7.2	2.5	Cing Gyr Control	73.2	40.6
BA9 Depression	3.5	3.1	Cing Gyr Control2	38.2	17.4
BA9 Depression2	7.9	1.6	Cing Gyr Alzheimer's	25.5	8.8
BA17 Control	59.0	19.6	Cing Gyr Alzheimer's2	9.5	1.4
BA17 Control2	67.8	39.5	Cing Gyr Parkinson's	24.3	9.3
BA17 Alzheimer's2	16.8	1.8	Cing Gyr Parkinson's2	34.4	32.8
BA17 Parkinson's	37.4	9.1	Cing Gyr Huntington's	63.7	38.4
BA17 Parkinson's2	56.6	36.6	Cing Gyr Huntington's2	12.5	4.6
BA17 Huntington's	37.1	16.3	Cing Gyr PSP	15.5	7.5
BA17 Huntington's2	15.9	5.1	Cing Gyr PSP2	5.8	0.0
BA17 Depression	6.1	0.0	Cing Gyr Depression	2.9	0.0
BA17 Depression2	28.1	7.1	Cing Gyr Depression2	9.2	1.8

**CNS\_neurodegeneration\_v1.0 Summary:** Ag2847/2880 No clear relationship between the expression levels of the CG55920-01 gene and Alzheimer's disease is evident in panel CNS\_neurodegeneration\_v1.0. See Panel 1.3D for discussion of utility of this gene in the central nervous system.

5 **Panel 1.3D Summary:** Ag2847/2880 Two experiments with two different probe and primer sets show highest expression of the CG55920-01 gene, a kilon homolog, in the brain. This expression profile is consistent with published reports of kilon expression. The sequence of kilon shows a high degree of homology to that of the chicken protein neurotractin, a molecule involved in neurite outgrowth capable of interacting with LAMP.

10 Because this class of molecule is thought to play a role in the guidance of growing axons, and kilon is expressed specifically in neurons, it has been suggested that they confer the ability to rearrange dendritic connectivity on magnocellular neurons. Degeneration of dendritic morphology and connectivity is a pathological characteristic of neurodegenerative diseases, such as Alzheimer's disease. Recombinant neurotractin promotes neurite outgrowth of telencephalic



neurons and interacts with the IgSF members CEPU-1. Therefore, this gene product may be used as a protein therapeutic to counter neurodegeneration in a range of neurodegenerative diseases.

In addition to the brain preferential expression on this panel, expression is relatively absent in brain cancer derived cell lines. Thus, the expression of this gene could be used to distinguish brain-derived tissue from other tissues in the panel. Moreover, therapeutic modulation of this gene, through the use of small molecule drugs, antibodies or protein therapeutics might be of use in the treatment of brain cancer.

This gene is also moderately expressed in a variety of metabolic tissues including pancreas, adrenal, thyroid, pituitary, adult and fetal heart, and adipose. Thus, this gene may be an antibody target for the treatment of disease in these tissues, including Types 1 and 2 diabetes, and obesity.

**Panel 2D Summary:** Ag2847/2880 Two experiments with different probe and primer sets produce results that are in very good agreement, with highest expression of the CG55920-01 gene in a sample derived from normal colon tissue (CTs=27-29). In addition, there is substantial expression of this gene in samples derived from normal colon tissue when compared to their adjacent malignant counterparts. The trend toward differential expression in normal tissues over their malignant counterparts is also seen in kidney samples and bladder samples. Thus, the expression of this gene could be used to distinguish normal colon, bladder or kidney from their malignant counterparts. Moreover, therapeutic modulation of this gene, through the use of small molecule drugs, antibodies or protein therapeutics might be of use in the treatment of colon, bladder or kidney cancer.

**Panel 4D Summary:** Ag2880 The CG55920-01 transcript is expressed in endothelial cells, fibroblasts, activated Ramos B cells and activated CD45RA (naive) T cells but not in primary B cells. This transcript encodes a putative adhesion molecule that has been hypothesized to be involved in the establishment and remodeling of neural circuits. The role of this protein in the immune system has not been examined, however, based on its CNS function it may be involved in cell-cell binding that leads to leukocyte interactions with endothelium resulting in leukocyte extravasation. Alternatively, the protein encoded for by this transcript may be important in other cellular interactions. Therapeutics designed with the protein encoded for by this transcript could be important in the treatment of inflammation resulting from asthma, chronic obstructive pulmonary disease, inflammatory bowel disease, arthritis, and psoriasis. Please note that data from a second experiment using the probe and primer set

Ag2847 is not included because the amp plot suggests that there were experimental difficulties with this run.

- Panel CNS\_1 Summary:** Ag2847/2880 Two experiments with different probe and primer sets produce results that are in very good agreement, confirming expression of the CG55920-01 gene in the brain. See Panel 1.3D for discussion of utility of this gene in the central nervous system.

#### L. CG55988-01: ORGANIC CATION TRANSPORTER (NOV13a)

Expression of gene CG55988-01 was assessed using the primer-probe set Ag2861, described in Table LA. Results of the RTQ-PCR runs are shown in Tables LB, LC and LD.

10 Table LA. Probe Name Ag2861

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-tctcttgagattccagagagt-3'	193	311
Probe	TET-5'-tgtgccttccagaacatctctgtgg-3'-TAMRA	228	312
Reverse	5'-tgaacacagaagccaagtagtg-3'	258	313

Table LB. Panel 1.3D

Tissue Name	Rel. Exp.(%) Ag2861, Run 161974432	Rel. Exp.(%) Ag2861, Run 165721638	Tissue Name	Rel. Exp.(%) Ag2861, Run 161974432	Rel. Exp.(%) Ag2861, Run 165721638
Liver adenocarcinoma	0.0	0.0	Kidney (fetal)	4.1	2.2
Pancreas	0.0	0.0	Renal ca. 786- 0	0.0	0.0
Pancreatic ca. CAPAN 2	0.0	0.0	Renal ca. A498	0.0	0.0
Adrenal gland	0.0	0.0	Renal ca. RXF 393	0.0	0.0
Thyroid	0.0	0.0	Renal ca. ACHN	0.0	0.0
Salivary gland	0.0	0.0	Renal ca. UO- 31	0.0	0.0
Pituitary gland	0.0	0.0	Renal ca. TK- 10	0.0	0.0
Brain (fetal)	0.0	1.5	Liver	0.0	0.0
Brain (whole)	0.0	0.0	Liver (fetal)	32.3	35.8
Brain (amygdala)	0.0	0.0	Liver ca. (hepatoblast) HepG2	1.5	1.6
Brain (cerebellum)	0.0	0.0	Lung	0.0	0.0
Brain	0.0	1.5	Lung (fetal)	0.0	0.0

(hippocampus)					
Brain (substantia nigra)	0.0	0.0	Lung ca. (small cell) LX-1	0.0	0.0
Brain (thalamus)	0.0	0.0	Lung ca. (small cell) NCI-H69	0.0	0.0
Cerebral Cortex	0.5	0.0	Lung ca. (s.cell var.) SHP-77	0.0	0.0
Spinal cord	0.0	0.0	Lung ca. (large cell) NCI-H460	0.0	0.0
glio/astro U87-MG	0.0	0.0	Lung ca. (non-sm. cell) A549	0.0	0.0
glio/astro U-118-MG	0.0	0.0	Lung ca. (non-s.cell) NCI-H23	0.0	1.9
astrocytoma SW1783	0.0	0.0	Lung ca. (non-s.cell) HOP-62	0.0	0.0
neuro*; met SK-N-AS	0.0	0.0	Lung ca. (non-s.cl) NCI-H522	0.0	0.0
astrocytoma SF-539	0.0	0.0	Lung ca. (squam.) SW 900	0.0	0.0
astrocytoma SNB-75	0.0	0.0	Lung ca. (squam.) NCI-H596	1.7	2.0
glioma SNB-19	0.0	0.0	Mammary gland	12.8	1.6
glioma U251	1.1	0.0	Breast ca.* (pl.ef) MCF-7	0.0	0.0
glioma SF-295	0.0	0.0	Breast ca.* (pl.ef) MDA-MB-231	0.0	0.0
Heart (fetal)	6.9	0.0	Breast ca.* (pl.ef) T47D	0.0	0.0
Heart	0.0	0.0	Breast ca. BT-549	0.0	1.0
Skeletal muscle (fetal)	11.4	0.0	Breast ca. MDA-N	0.0	0.0
Skeletal muscle	0.0	0.0	Ovary	2.0	0.0
Bone marrow	100.0	100.0	Ovarian ca. OVCA-3	0.0	0.0
Thymus	6.3	0.7	Ovarian ca. OVCA-4	0.0	0.0
Spleen	0.0	0.0	Ovarian ca.	0.0	0.0

			OVCA-5		
Lymph node	1.4	0.0	Ovarian ca. OVCA-8	0.0	0.0
Colorectal	0.0	1.4	Ovarian ca. IGROV-1	0.0	0.0
Stomach	0.0	0.0	Ovarian ca.* (ascites) SK- OV-3	0.0	3.2
Small intestine	0.0	0.0	Uterus	6.7	7.9
Colon ca. SW480	0.0	0.0	Placenta	0.9	1.5
Colon ca.* SW620(SW480 met)	0.0	0.0	Prostate	0.0	0.0
Colon ca. HT29	0.0	1.4	Prostate ca.* (bone met)PC- 3	0.0	0.0
Colon ca. HCT- 116	0.0	0.0	Testis	33.4	12.5
Colon ca. CaCo-2	0.0	0.0	Melanoma Hs688(A).T	0.0	0.0
Colon ca. tissue(ODO3866)	2.8	0.0	Melanoma* (met) Hs688(B).T	0.0	0.0
Colon ca. HCC- 2998	0.0	0.0	Melanoma UACC-62	0.0	0.0
Gastric ca.* (liver met) NCI-N87	0.0	0.0	Melanoma M14	0.0	0.5
Bladder	4.0	0.0	Melanoma LOX IMVI	0.0	0.0
Trachea	11.2	0.0	Melanoma* (met) SK- MEL-5	0.0	0.0
Kidney	0.0	0.0	Adipose	1.5	0.4

Table LC. Panel 2D

Tissue Name	Rel. Exp.(%) Ag2861, Run 161974611	Tissue Name	Rel. Exp.(%) Ag2861, Run 161974611
Normal Colon	0.6	Kidney Margin 8120608	0.0
CC Well to Mod Diff (ODO3866)	0.5	Kidney Cancer 8120613	0.0
CC Margin (ODO3866)	0.3	Kidney Margin 8120614	0.0
CC Gr.2 rectosigmoid (ODO3868)	0.0	Kidney Cancer 9010320	0.6

CC Margin (ODO3868)	0.0	Kidney Margin 9010321	0.3
CC Mod Diff (ODO3920)	0.1	Normal Uterus	1.0
CC Margin (ODO3920)	0.0	Uterus Cancer 064011	0.2
CC Gr.2 ascend colon (ODO3921)	0.2	Normal Thyroid	0.0
CC Margin (ODO3921)	0.3	Thyroid Cancer 064010	0.2
CC from Partial Hepatectomy (ODO4309) Mets	0.1	Thyroid Cancer A302152	0.0
Liver Margin (ODO4309)	0.3	Thyroid Margin A302153	0.0
Colon mets to lung (OD04451-01)	0.0	Normal Breast	0.0
Lung Margin (OD04451-02)	0.1	Breast Cancer (OD04566)	0.0
Normal Prostate 6546-1	0.0	Breast Cancer (OD04590-01)	0.0
Prostate Cancer (OD04410)	0.7	Breast Cancer Mets (OD04590-03)	0.1
Prostate Margin (OD04410)	0.0	Breast Cancer Metastasis (OD04655-05)	0.4
Prostate Cancer (OD04720-01)	0.2	Breast Cancer 064006	0.0
Prostate Margin (OD04720-02)	0.0	Breast Cancer 1024	0.9
Normal Lung 061010	0.6	Breast Cancer 9100266	0.0
Lung Met to Muscle (ODO4286)	0.6	Breast Margin 9100265	0.7
Muscle Margin (ODO4286)	0.5	Breast Cancer A209073	0.4
Lung Malignant Cancer (OD03126)	0.2	Breast Margin A2090734	0.7
Lung Margin (OD03126)	0.5	Normal Liver	0.0
Lung Cancer (OD04404)	0.4	Liver Cancer 064003	0.0
Lung Margin (OD04404)	1.3	Liver Cancer 1025	0.0
Lung Cancer (OD04565)	0.2	Liver Cancer 1026	0.0
Lung Margin (OD04565)	0.8	Liver Cancer 6004-T	0.3
Lung Cancer (OD04237-01)	0.2	Liver Tissue 6004-N	0.1
Lung Margin (OD04237-02)	0.7	Liver Cancer 6005-T	0.0

Ocular Mel Met to Liver (ODO4310)	0.0	Liver Tissue 6005-N	0.0
Liver Margin (ODO4310)	0.0	Normal Bladder	0.0
Melanoma Mets to Lung (OD04321)	0.7	Bladder Cancer 1023	0.2
Lung Margin (OD04321)	3.7	Bladder Cancer A302173	1.7
Normal Kidney	0.5	Bladder Cancer (OD04718-01)	0.6
Kidney Ca, Nuclear grade 2 (OD04338)	1.1	Bladder Normal Adjacent (OD04718-03)	0.0
Kidney Margin (OD04338)	0.9	Normal Ovary	0.0
Kidney Ca Nuclear grade 1/2 (OD04339)	0.0	Ovarian Cancer 064008	0.2
Kidney Margin (OD04339)	0.0	Ovarian Cancer (OD04768-07)	100.0
Kidney Ca, Clear cell type (OD04340)	0.1	Ovary Margin (OD04768-08)	0.0
Kidney Margin (OD04340)	0.0	Normal Stomach	0.0
Kidney Ca, Nuclear grade 3 (OD04348)	0.7	Gastric Cancer 9060358	0.1
Kidney Margin (OD04348)	0.0	Stomach Margin 9060359	0.5
Kidney Cancer (OD04622-01)	1.1	Gastric Cancer 9060395	0.0
Kidney Margin (OD04622-03)	0.0	Stomach Margin 9060394	0.6
Kidney Cancer (OD04450-01)	0.0	Gastric Cancer 9060397	0.7
Kidney Margin (OD04450-03)	0.0	Stomach Margin 9060396	0.0
Kidney Cancer 8120607	0.3	Gastric Cancer 064005	0.2

Table LD. Panel 4D

Tissue Name	Rel. Exp.(%) Ag2861, Run 159616582	Tissue Name	Rel. Exp.(%) Ag2861, Run 159616582
Secondary Th1 act	0.0	HUVEC IL-1beta	0.0
Secondary Th2 act	0.0	HUVEC IFN gamma	0.0
Secondary Tr1 act	0.0	HUVEC TNF alpha + IFN gamma	0.0
Secondary Th1 rest	0.0	HUVEC TNF alpha + IL4	0.0

Secondary Th2 rest	0.0	HUVEC IL-11	0.0
Secondary Tr1 rest	0.0	Lung Microvascular EC none	1.4
Primary Th1 act	0.0	Lung Microvascular EC TNFalpha + IL-1beta	0.0
Primary Th2 act	0.0	Microvascular Dermal EC none	0.0
Primary Tr1 act	0.0	Microvascular Dermal EC TNFalpha + IL-1beta	0.0
Primary Th1 rest	0.0	Bronchial epithelium TNFalpha + IL1beta	0.0
Primary Th2 rest	1.7	Small airway epithelium none	0.0
Primary Tr1 rest	0.0	Small airway epithelium TNFalpha + IL-1beta	0.0
CD45RA CD4 lymphocyte act	0.0	Coronary artery SMC rest	0.0
CD45RO CD4 lymphocyte act	0.0	Coronary artery SMC TNFalpha + IL-1beta	0.0
CD8 lymphocyte act	0.0	Astrocytes rest	0.0
Secondary CD8 lymphocyte rest	0.6	Astrocytes TNFalpha + IL-1beta	0.0
Secondary CD8 lymphocyte act	0.0	KU-812 (Basophil) rest	54.3
CD4 lymphocyte none	0.0	KU-812 (Basophil) PMA/ionomycin	71.2
2ry Th1/Th2/Tr1_anti-CD95 CH11	0.0	CCD1106 (Keratinocytes) none	2.6
LAK cells rest	12.8	CCD1106 (Keratinocytes) TNFalpha + IL-1beta	0.0
LAK cells IL-2	0.0	Liver cirrhosis	4.5
LAK cells IL-2+IL-12	1.1	Lupus kidney	0.0
LAK cells IL-2+IFN gamma	1.0	NCI-H292 none	0.0
LAK cells IL-2+ IL-18	0.8	NCI-H292 IL-4	0.0
LAK cells PMA/ionomycin	0.0	NCI-H292 IL-9	0.0
NK Cells IL-2 rest	0.0	NCI-H292 IL-13	1.4
Two Way MLR 3 day	11.0	NCI-H292 IFN gamma	0.0
Two Way MLR 5 day	0.6	HPAEC none	0.0
Two Way MLR 7 day	0.0	HPAEC TNF alpha + IL-1 beta	0.0
PBMC rest	3.8	Lung fibroblast none	0.0
PBMC PWM	0.0	Lung fibroblast TNF alpha + IL-1 beta	0.0

PBMC PHA-L	0.0	Lung fibroblast IL-4	2.5
Ramos (B cell) none	0.0	Lung fibroblast IL-9	0.0
Ramos (B cell) ionomycin	0.0	Lung fibroblast IL-13	3.0
B lymphocytes PWM	0.0	Lung fibroblast IFN gamma	0.0
B lymphocytes CD40L and IL-4	1.3	Dermal fibroblast CCD1070 rest	0.0
EOL-1 dbcAMP	0.0	Dermal fibroblast CCD1070 TNF alpha	0.0
EOL-1 dbcAMP PMA/ionomycin	0.0	Dermal fibroblast CCD1070 IL-1 beta	0.0
Dendritic cells none	25.3	Dermal fibroblast IFN gamma	0.0
Dendritic cells LPS	100.0	Dermal fibroblast IL-4	0.0
Dendritic cells anti-CD40	69.7	IBD Colitis 2	0.0
Monocytes rest	36.1	IBD Crohn's	0.0
Monocytes LPS	7.4	Colon	0.0
Macrophages rest	94.0	Lung	2.1
Macrophages LPS	31.9	Thymus	0.0
HUVEC none	0.0	Kidney	34.4
HUVEC starved	0.0		

**Panel 1.3D Summary:** Ag2861 The expression of the CG55988-01 gene is highest in bone marrow (CTs=31-32) in two experiments with the same probe and primer. In addition, there was substantial expression in samples derived from testis and fetal liver. This expression profile is consistent with published data (See references below). Thus, the expression of this gene could be used to distinguish these tissues from other tissues in the panel. Furthermore, the higher levels of expression in fetal liver when compared to adult liver suggest that this gene product may be involved in the development and homeostasis of the liver. Thus, therapeutic modulation of the expression or function of the protein encoded by this gene may be effective in the treatment of diseases that affect the liver or the function of this gene product in the liver.

**Panel 4D Summary:** Ag2861 The CG55988-01 transcript is expressed in KU-812 cells, macrophages and dendritic cells (CTs=31-33). The transcript is more highly expressed in resting macrophages and monocytes than in treated cells of these types, but is induced in anti-CD40 or LPS treated dendritic cells. The protein encoded by this transcript may be important in monocytic differentiation and in dendritic cell differentiation and activation. Therefore, regulating the expression of this transcript or the function of the protein it encodes could alter



Control 4 Hippo	15.4	13.1	AD 6 Occipital Ctx	18.2	43.5
Control (Path) 3 Hippo	8.7	12.9	Control 1 Occipital Ctx	6.6	5.5
AD 1 Temporal Ctx	12.4	9.7	Control 2 Occipital Ctx	67.4	60.7
AD 2 Temporal Ctx	34.9	40.6	Control 3 Occipital Ctx	26.2	28.9
AD 3 Temporal Ctx	6.3	5.0	Control 4 Occipital Ctx	7.6	5.5
AD 4 Temporal Ctx	13.4	28.9	Control (Path) 1 Occipital Ctx	92.0	68.8
AD 5 Inf Temporal Ctx	100.0	100.0	Control (Path) 2 Occipital Ctx	18.9	15.6
AD 5 Sup Temporal Ctx	57.0	46.3	Control (Path) 3 Occipital Ctx	3.8	2.7
AD 6 Inf Temporal Ctx	32.3	33.4	Control (Path) 4 Occipital Ctx	35.1	30.6
AD 6 Sup Temporal Ctx	45.4	39.0	Control 1 Parietal Ctx	15.5	10.1
Control 1 Temporal Ctx	10.0	12.6	Control 2 Parietal Ctx	47.0	36.3
Control 2 Temporal Ctx	53.6	43.2	Control 3 Parietal Ctx	17.3	29.5
Control 3 Temporal Ctx	28.1	20.7	Control (Path) 1 Parietal Ctx	94.6	77.9
Control 3 Temporal Ctx	16.8	15.6	Control (Path) 2 Parietal Ctx	35.4	41.2
Control (Path) 1	73.2	63.3	Control (Path) 3	4.3	6.2

Temporal Ctx			Parietal Ctx		
Control (Path) 2 Temporal Ctx	57.8	43.2	Control (Path) 4 Parietal Ctx	68.8	59.5

Table MC. Panel 1.3D

Tissue Name	Rel. Exp.(%) Ag2868, Run 162011291	Tissue Name	Rel. Exp.(%) Ag2868, Run 162011291
Liver adenocarcinoma	0.5	Kidney (fetal)	9.1
Pancreas	1.1	Renal ca. 786-0	0.0
Pancreatic ca. CAPAN 2	1.6	Renal ca. A498	1.1
Adrenal gland	1.0	Renal ca. RXF 393	2.8
Thyroid	9.9	Renal ca. ACHN	1.5
Salivary gland	7.0	Renal ca. UO-31	2.7
Pituitary gland	3.0	Renal ca. TK-10	3.4
Brain (fetal)	3.3	Liver	36.9
Brain (whole)	23.5	Liver (fetal)	24.7
Brain (amygdala)	13.7	Liver ca. (hepatoblast) HepG2	5.0
Brain (cerebellum)	28.3	Lung	1.4
Brain (hippocampus)	31.6	Lung (fetal)	3.4
Brain (substantia nigra)	8.5	Lung ca. (small cell) LX-1	2.8
Brain (thalamus)	16.8	Lung ca. (small cell) NCI-H69	7.1
Cerebral Cortex	100.0	Lung ca. (s.cell var.) SHP-77	3.1
Spinal cord	10.2	Lung ca. (large cell) NCI-H460	0.3
glio/astro U87-MG	1.3	Lung ca. (non-sm. cell) A549	0.7
glio/astro U-118-MG	0.4	Lung ca. (non-s.cell) NCI-H23	0.6
astrocytoma SW1783	4.7	Lung ca. (non-s.cell) HOP-62	2.8
neuro*; met SK-N-AS	1.0	Lung ca. (non-s.cl) NCI-H522	0.4
astrocytoma SF-539	6.5	Lung ca. (squam.) SW 900	0.9
astrocytoma SNB-75	1.4	Lung ca. (squam.) NCI-H596	3.4
glioma SNB-19	11.5	Mammary gland	9.9

glioma U251	5.1	Breast ca.* (pl.ef) MCF-7	13.3
glioma SF-295	0.5	Breast ca.* (pl.ef) MDA-MB-231	3.2
Heart (fetal)	45.1	Breast ca.* (pl.ef) T47D	12.2
Heart	21.9	Breast ca. BT-549	1.6
Skeletal muscle (fetal)	27.9	Breast ca. MDA-N	3.9
Skeletal muscle	20.2	Ovary	10.4
Bone marrow	3.5	Ovarian ca. OVCAR-3	4.5
Thymus	30.1	Ovarian ca. OVCAR-4	2.6
Spleen	3.0	Ovarian ca. OVCAR-5	3.7
Lymph node	2.4	Ovarian ca. OVCAR-8	5.3
Colorectal	52.5	Ovarian ca. IGROV-1	0.7
Stomach	6.7	Ovarian ca.* (ascites) SK-OV-3	1.0
Small intestine	17.1	Uterus	1.2
Colon ca. SW480	9.7	Placenta	0.2
Colon ca.* SW620(SW480 met)	3.8	Prostate	14.5
Colon ca. HT29	13.1	Prostate ca.* (bone met)PC-3	1.1
Colon ca. HCT-116	3.5	Testis	2.3
Colon ca. CaCo-2	14.1	Melanoma Hs688(A).T	0.1
Colon ca. tissue(ODO3866)	17.8	Melanoma* (met) Hs688(B).T	0.6
Colon ca. HCC-2998	18.0	Melanoma UACC-62	0.0
Gastric ca.* (liver met) NCI-N87	7.9	Melanoma M14	2.3
Bladder	5.6	Melanoma LOX IMVI	0.2
Trachea	28.5	Melanoma* (met) SK-MEL-5	0.1
Kidney	29.9	Adipose	1.0

Table MD. Panel 2D

Tissue Name	Rel. Exp.(%) Ag2868, Run 162011370	Tissue Name	Rel. Exp.(%) Ag2868, Run 162011370
-------------	--	-------------	--

Normal Colon	43.8	Kidney Margin 8120608	9.7
CC Well to Mod Diff (ODO3866)	5.9	Kidney Cancer 8120613	31.9
CC Margin (ODO3866)	8.9	Kidney Margin 8120614	13.8
CC Gr.2 rectosigmoid (ODO3868)	19.1	Kidney Cancer 9010320	4.9
CC Margin (ODO3868)	1.4	Kidney Margin 9010321	17.1
CC Mod Diff (ODO3920)	34.2	Normal Uterus	0.3
CC Margin (ODO3920)	15.7	Uterus Cancer 064011	3.4
CC Gr.2 ascend colon (ODO3921)	38.4	Normal Thyroid	8.0
CC Margin (ODO3921)	16.0	Thyroid Cancer 064010	7.5
CC from Partial Hepatectomy (ODO4309) Mets	28.7	Thyroid Cancer A302152	6.8
Liver Margin (ODO4309)	100.0	Thyroid Margin A302153	8.2
Colon mets to lung (OD04451-01)	6.7	Normal Breast	4.6
Lung Margin (OD04451- 02)	0.8	Breast Cancer (OD04566)	12.1
Normal Prostate 6546-1	4.1	Breast Cancer (OD04590-01)	22.1
Prostate Cancer (OD04410)	20.3	Breast Cancer Mets (OD04590-03)	22.7
Prostate Margin (OD04410)	16.3	Breast Cancer Metastasis (OD04655-05)	23.8
Prostate Cancer (OD04720-01)	8.4	Breast Cancer 064006	4.8
Prostate Margin (OD04720-02)	11.2	Breast Cancer 1024	41.2
Normal Lung 061010	6.7	Breast Cancer 9100266	16.0
Lung Met to Muscle (ODO4286)	0.5	Breast Margin 9100265	6.9
Muscle Margin (ODO4286)	0.3	Breast Cancer A209073	5.5
Lung Malignant Cancer (OD03126)	10.4	Breast Margin A2090734	7.8
Lung Margin (OD03126)	4.1	Normal Liver	55.5
Lung Cancer (OD04404)	20.9	Liver Cancer 064003	17.7

Lung Margin (OD04404)	1.4	Liver Cancer 1025	70.7
Lung Cancer (OD04565)	3.7	Liver Cancer 1026	20.3
Lung Margin (OD04565)	1.3	Liver Cancer 6004-T	90.1
Lung Cancer (OD04237-01)	14.2	Liver Tissue 6004-N	5.2
Lung Margin (OD04237-02)	1.0	Liver Cancer 6005-T	17.2
Ocular Mel Met to Liver (ODO4310)	6.8	Liver Tissue 6005-N	32.5
Liver Margin (ODO4310)	58.6	Normal Bladder	5.4
Melanoma Mets to Lung (OD04321)	5.7	Bladder Cancer 1023	2.8
Lung Margin (OD04321)	2.9	Bladder Cancer A302173	2.5
Normal Kidney	30.1	Bladder Cancer (OD04718-01)	7.2
Kidney Ca, Nuclear grade 2 (OD04338)	42.9	Bladder Normal Adjacent (OD04718-03)	1.4
Kidney Margin (OD04338)	17.6	Normal Ovary	1.5
Kidney Ca Nuclear grade 1/2 (OD04339)	7.3	Ovarian Cancer 064008	9.6
Kidney Margin (OD04339)	14.7	Ovarian Cancer (OD04768-07)	1.4
Kidney Ca, Clear cell type (OD04340)	0.3	Ovary Margin (OD04768-08)	0.2
Kidney Margin (OD04340)	14.1	Normal Stomach	4.8
Kidney Ca, Nuclear grade 3 (OD04348)	0.2	Gastric Cancer 9060358	0.6
Kidney Margin (OD04348)	7.3	Stomach Margin 9060359	5.0
Kidney Cancer (OD04622-01)	9.3	Gastric Cancer 9060395	7.9
Kidney Margin (OD04622-03)	4.0	Stomach Margin 9060394	6.8
Kidney Cancer (OD04450-01)	10.7	Gastric Cancer 9060397	16.8
Kidney Margin (OD04450-03)	11.7	Stomach Margin 9060396	3.4
Kidney Cancer 8120607	2.4	Gastric Cancer 064005	8.0

Table ME. Panel 4D

Tissue Name	Rel. Exp.(%)	Tissue Name	Rel. Exp.(%)
-------------	--------------	-------------	--------------

	<b>Ag2868, Run 159776784</b>		<b>Ag2868, Run 159776784</b>
Secondary Th1 act	48.0	HUVEC IL-1beta	0.1
Secondary Th2 act	40.9	HUVEC IFN gamma	2.7
Secondary Tr1 act	55.1	HUVEC TNF alpha + IFN gamma	0.3
Secondary Th1 rest	3.1	HUVEC TNF alpha + IL4	1.1
Secondary Th2 rest	7.8	HUVEC IL-11	2.6
Secondary Tr1 rest	12.5	Lung Microvascular EC none	1.9
Primary Th1 act	64.6	Lung Microvascular EC TNFalpha + IL-1beta	1.8
Primary Th2 act	52.9	Microvascular Dermal EC none	1.0
Primary Tr1 act	88.3	Microsvascular Dermal EC TNFalpha + IL-1beta	1.4
Primary Th1 rest	54.0	Bronchial epithelium TNFalpha + IL1beta	1.1
Primary Th2 rest	30.6	Small airway epithelium none	3.8
Primary Tr1 rest	<b>100.0</b>	Small airway epithelium TNFalpha + IL-1beta	14.2
CD45RA CD4 lymphocyte act	17.0	Coronary artery SMC rest	0.3
CD45RO CD4 lymphocyte act	33.0	Coronary artery SMC TNFalpha + IL-1beta	0.0
CD8 lymphocyte act	30.8	Astrocytes rest	3.0
Secondary CD8 lymphocyte rest	30.8	Astrocytes TNFalpha + IL-1beta	1.7
Secondary CD8 lymphocyte act	16.4	KU-812 (Basophil) rest	25.3
CD4 lymphocyte none	3.5	KU-812 (Basophil) PMA/ionomycin	50.0
2ry Th1/Th2/Tr1_anti- CD95 CH11	9.9	CCD1106 (Keratinocytes) none	12.7
LAK cells rest	10.2	CCD1106 (Keratinocytes) TNFalpha + IL-1beta	0.5
LAK cells IL-2	24.5	Liver cirrhosis	3.8
LAK cells IL-2+IL-12	30.4	Lupus kidney	2.0
LAK cells IL-2+IFN gamma	31.4	NCI-H292 none	31.4
LAK cells IL-2+ IL-18	33.0	NCI-H292 IL-4	36.1
LAK cells PMA/ionomycin	1.8	NCI-H292 IL-9	41.8
NK Cells IL-2 rest	14.5	NCI-H292 IL-13	25.5

Two Way MLR 3 day	6.4	NCI-H292 IFN gamma	23.7
Two Way MLR 5 day	13.6	HPAEC none	1.0
Two Way MLR 7 day	11.7	HPAEC TNF alpha + IL-1 beta	0.2
PBMC rest	2.0	Lung fibroblast none	1.5
PBMC PWM	43.8	Lung fibroblast TNF alpha + IL-1 beta	0.3
PBMC PHA-L	22.7	Lung fibroblast IL-4	1.0
Ramos (B cell) none	23.7	Lung fibroblast IL-9	1.9
Ramos (B cell) ionomycin	62.9	Lung fibroblast IL-13	0.7
B lymphocytes PWM	76.8	Lung fibroblast IFN gamma	0.5
B lymphocytes CD40L and IL-4	26.6	Dermal fibroblast CCD1070 rest	1.8
EOL-1 dbcAMP	27.2	Dermal fibroblast CCD1070 TNF alpha	31.6
EOL-1 dbcAMP PMA/ionomycin	12.3	Dermal fibroblast CCD1070 IL-1 beta	2.3
Dendritic cells none	8.1	Dermal fibroblast IFN gamma	0.2
Dendritic cells LPS	3.1	Dermal fibroblast IL-4	2.6
Dendritic cells anti-CD40	5.9	IBD Colitis 2	0.6
Monocytes rest	1.2	IBD Crohn's	3.0
Monocytes LPS	0.9	Colon	31.6
Macrophages rest	15.1	Lung	2.9
Macrophages LPS	1.4	Thymus	29.5
HUVEC none	1.7	Kidney	11.9
HUVEC starved	1.8		

Table MF. Panel 5 Islet

Tissue Name	Rel. Exp.(%) Ag2868, Run 233071460	Tissue Name	Rel. Exp.(%) Ag2868, Run 233071460
97457_Patient-02go_adipose	1.6	94709_Donor 2 AM - A_adipose	6.4
97476_Patient-07sk_skeletal muscle	0.0	94710_Donor 2 AM - B_adipose	0.0
97477_Patient-07ut_uterus	3.5	94711_Donor 2 AM - C_adipose	0.0
97478_Patient-07pl_placenta	9.4	94712_Donor 2 AD - A_adipose	4.0
99167_Bayer Patient 1	12.2	94713_Donor 2 AD - B_adipose	2.0
97482_Patient-	0.7	94714_Donor 2 AD - C_adipose	0.0

08ut_uterus			
97483_Patient-08pl_placenta	4.0	94742_Donor 3 U - A_Mesenchymal Stem Cells	0.0
97486_Patient-09sk_skeletal muscle	0.0	94743_Donor 3 U - B_Mesenchymal Stem Cells	0.0
97487_Patient-09ut_uterus	4.0	94730_Donor 3 AM - A_adipose	3.9
97488_Patient-09pl_placenta	9.8	94731_Donor 3 AM - B_adipose	1.7
97492_Patient-10ut_uterus	6.6	94732_Donor 3 AM - C_adipose	4.1
97493_Patient-10pl_placenta	6.1	94733_Donor 3 AD - A_adipose	1.2
97495_Patient-11go_adipose	7.5	94734_Donor 3 AD - B_adipose	2.0
97496_Patient-11sk_skeletal muscle	12.5	94735_Donor 3 AD - C_adipose	3.7
97497_Patient-11ut_uterus	3.9	77138_Liver_HepG2untreated	85.3
97498_Patient-11pl_placenta	5.0	73556_Heart_Cardiac stromal cells (primary)	0.0
97500_Patient-12go_adipose	13.8	81735_Small Intestine	58.2
97501_Patient-12sk_skeletal muscle	20.6	72409_Kidney_Proximal Convoluted Tubule	11.6
97502_Patient-12ut_uterus	1.3	82685_Small intestine_Duodenum	58.2
97503_Patient-12pl_placenta	2.1	90650_Adrenal_Adrenocortical adenoma	5.4
94721_Donor 2 U - A_Mesenchymal Stem Cells	2.9	72410_Kidney_HRCE	100.0
94722_Donor 2 U - B_Mesenchymal Stem Cells	1.5	72411_Kidney_HRE	35.1
94723_Donor 2 U - C_Mesenchymal Stem Cells	3.3	73139_Uterus_Uterine smooth muscle cells	0.0

- CNS\_neurodegeneration\_v1.0 Summary:** Ag2868 No association is evident between the CG56001-01 gene expression levels and Alzheimer's disease. This is not surprising however, because D-beta-hydroxybutyrate dehydrogenase function appears to be controlled, at the translational, post-translational and catalytic levels. (See ref. below). This
- 5 panel confirms expression of this gene in the brain. See Panel 1.3D for discussion of utility of this gene in the central nervous system.



**Panel 1.3D Summary:** Ag2868 Expression of the CG56001-01 gene is highest in the cerebral cortex (CT=27.6). The expression of this gene in multiple brain regions is consistent with a published role for this gene in CNS energetic processes. D-beta-hydroxybutyrate protects neurons in models of Alzheimer's and Parkinson's disease. Other enzymes, such as amyloid beta-peptide-binding alcohol dehydrogenase, which have been shown to possess D-beta-hydroxybutyrate dehydrogenase activity, contribute to the protective response to metabolic stress, especially in the setting of ischemia. Since this gene product processes D-beta-hydroxybutyrate to provide a neuronal energy source, activators of the protein encoded by this gene may be useful in treating and protecting the CNS of Alzheimer's and Parkinson's disease patients, as well as stroke.

Overall, expression of this gene appears to be largely associated with normal tissues when compared to cancer cell lines. Thus, the expression of this gene could be used to distinguish normal tissues from the other tissues in the panel. Moreover, therapeutic modulation of this gene, through the use of small molecule drugs, antibodies or protein therapeutics might be of benefit in the treatment of cancer.

This gene is also moderately expressed in a variety of metabolic tissues, including pancreas, adrenal, thyroid, pituitary, adult and fetal heart, adult and fetal skeletal muscle, adult and fetal liver and adipose. This gene encodes a hydroxybutyrate dehydrogenase homolog. Mutations in this fatty acid-oxidation enzyme are associated with hypoglycemia and cardiac arrest. Activators of this enzyme could be drug targets for obesity because increased fatty acid oxidation may prevent the incorporation of fatty acids into triglycerides, thus decreasing adipose mass.

**Panel 2D Summary:** Ag2868 The expression of the CG56001-01 gene appears to be highest in a sample derived from normal liver tissue adjacent to a metastatic colon cancer (CT=25.9). In addition, there appears to be substantial expression associated with malignant liver tissue when compared to their associated normal adjacent tissue. Thus, the expression of this gene could be used to distinguish liver derived tissue from the other samples in the panel. Moreover, therapeutic modulation of this gene, through the use of small molecule drugs, antibodies or protein therapeutics might be of benefit in the treatment of liver cancer.

**Panel 4D Summary:** Ag2868 The CG56001-01 transcript is expressed primarily in activated leukocytes, especially in T cells and B cells (CTs=27-30). It is also expressed in NCI-H292 cells and in TNF alpha treated dermal fibroblasts. The protein encoded by this transcript has homology to hydroxybutyrate dehydrogenase, a protein that has been found in

lymphocytes (ref below). Thus, the protein encoded for by this transcript may be important for cellular responses to inflammatory/activating stimuli. Therefore, therapeutics designed with the protein encoded for by this transcript could be used for the treatment of inflammatory diseases such as asthma, emphysema, COPD, arthritis, IBD and psoriasis.

- 5 **Panel 5 Islet Summary:** Ag2868 Expression of the CG56001-01 gene is highest a in kidney cell line (CT=32.8). Thus, expression of this gene could be used to differentiate between this sample and other samples on this panel.

**N. SC145665404\_A/CG55069-01 (NOV15a) and CG55069-02 (NOV15b) and CG55069-03 (NOV15c): TEN-M3 like**

- 10 Expression of gene SC145665404\_A and variants CG55069-02 and CG55069-03 was assessed using the primer-probe sets Ag2674, Ag1479 and Ag2820, described in Tables NA, NB and NC. Results of the RTQ-PCR runs are shown in Tables ND, NE, NF, and NG.

Table NA. Probe Name Ag2674

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-acctactcggccactacctaga-3'	993	317
Probe	TET-5'-caccctatcaagaagtgccttttaaattca-3'-TAMRA	1017	318
Reverse	5'-cagtgcattccagctacagta-3'	1060	319

Table NB. Probe Name Ag1479

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-cacggaacgtatcttcaagaaa-3'	2125	320
Probe	TET-5'-ctgcacgtgtgaccctaactggactg-3'-TAMRA	2154	321
Reverse	5'-gccacagtccacagaacatatt-3'	2199	322

- 15 Table NC. Probe Name Ag2820

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-cagagaagcagacgagttcact-3'	354	323
Probe	TET-5'-caaggacagaattttaccctaaggca-3'-TAMRA	379	324
Reverse	5'-gttgctggttcacaaactccta-3'	407	325

Table ND. CNS\_neurodegeneration\_v1.0

Tissue Name	Rel. Exp.(%) Ag2674, Run 206976322	Rel. Exp.(%) Ag2674, Run 237982180	Tissue Name	Rel. Exp.(%) Ag2674, Run 206976322	Rel. Exp.(%) Ag2674, Run 237982180
AD 1 Hippo	20.7	20.9	Control (Path) 3 Temporal Ctx	12.1	10.2
AD 2 Hippo	31.4	30.4	Control	39.5	37.1

			(Path) 4 Temporal Ctx		
AD 3 Hippo	18.9	9.7	AD 1 Occipital Ctx	11.5	11.9
AD 4 Hippo	7.9	6.8	AD 2 Occipital Ctx (Missing)	0.0	0.0
AD 5 hippo	100.0	60.3	AD 3 Occipital Ctx	7.9	6.0
AD 6 Hippo	62.9	61.6	AD 4 Occipital Ctx	15.4	17.8
Control 2 Hippo	34.9	29.9	AD 5 Occipital Ctx	0.0	34.4
Control 4 Hippo	15.6	8.3	AD 6 Occipital Ctx	40.3	28.9
Control (Path) 3 Hippo	18.3	19.3	Control 1 Occipital Ctx	7.4	4.5
AD 1 Temporal Ctx	21.2	16.2	Control 2 Occipital Ctx	42.9	28.3
AD 2 Temporal Ctx	39.0	38.4	Control 3 Occipital Ctx	18.8	17.1
AD 3 Temporal Ctx	14.8	9.9	Control 4 Occipital Ctx	9.1	7.6
AD 4 Temporal Ctx	26.4	32.1	Control (Path) 1 Occipital Ctx	72.2	46.7
AD 5 Inf Temporal Ctx	84.7	100.0	Control (Path) 2 Occipital Ctx	13.7	14.3
AD 5 SupTemporal Ctx	35.4	59.5	Control (Path) 3 Occipital Ctx	6.4	6.3
AD 6 Inf Temporal Ctx	64.6	54.0	Control (Path) 4	16.2	13.1

			Occipital Ctx		
AD 6 Sup Temporal Ctx	54.0	44.8	Control 1 Parietal Ctx	12.0	8.7
Control 1 Temporal Ctx	19.8	13.9	Control 2 Parietal Ctx	46.3	49.3
Control 2 Temporal Ctx	47.0	30.1	Control 3 Parietal Ctx	17.7	19.2
Control 3 Temporal Ctx	35.4	31.4	Control (Path) 1 Parietal Ctx	59.5	48.6
Control 4 Temporal Ctx	16.5	16.6	Control (Path) 2 Parietal Ctx	25.5	25.3
Control (Path) 1 Temporal Ctx	63.3	50.0	Control (Path) 3 Parietal Ctx	6.9	7.7
Control (Path) 2 Temporal Ctx	31.6	34.2	Control (Path) 4 Parietal Ctx	31.2	30.1

Table NE. Panel 1.3D

Tissue Name	Rel. Exp.(%) Ag1479, Run 165520101	Rel. Exp.(%) Ag2674, Run 162554642	Rel. Exp.(%) Ag2820, Run 165527000	Rel. Exp.(%) Ag2820, Run 165544916
Liver adenocarcinoma	16.0	15.9	17.2	8.2
Pancreas	0.5	0.1	0.0	0.1
Pancreatic ca. CAPAN 2	16.2	4.9	10.4	6.3
Adrenal gland	4.1	0.8	4.9	2.7
Thyroid	2.0	0.8	0.6	0.2
Salivary gland	0.2	0.1	0.0	0.1
Pituitary gland	3.5	0.6	0.8	0.1
Brain (fetal)	8.7	0.6	2.3	1.1
Brain (whole)	10.4	2.0	1.7	2.1
Brain (amygdala)	12.8	3.0	2.0	2.0
Brain (cerebellum)	10.0	1.8	0.3	0.3
Brain (hippocampus)	17.7	5.0	3.5	2.1
Brain (substantia nigra)	1.8	0.0	0.4	0.1
Brain (thalamus)	19.3	2.2	2.2	3.2
Cerebral Cortex	8.0	100.0	4.8	3.6
Spinal cord	1.4	1.1	0.4	1.0
glio/astro U87-MG	13.6	12.0	18.8	26.1

glio/astro U-118-MG	82.4	20.9	100.0	100.0
astrocytoma SW1783	27.9	21.5	24.8	19.3
neuro*; met SK-N-AS	31.2	8.7	18.8	16.3
astrocytoma SF-539	25.2	19.8	22.2	19.3
astrocytoma SNB-75	20.6	5.2	27.2	15.7
glioma SNB-19	4.7	1.6	4.0	3.4
glioma U251	100.0	7.9	88.3	76.8
glioma SF-295	5.6	3.3	5.6	3.5
Heart (fetal)	1.0	4.3	0.3	0.3
Heart	0.7	0.3	0.0	0.0
Skeletal muscle (fetal)	1.0	32.8	2.3	1.3
Skeletal muscle	6.0	2.0	0.0	0.2
Bone marrow	0.0	0.0	0.0	0.0
Thymus	0.2	0.7	0.5	0.6
Spleen	0.7	0.3	1.0	0.9
Lymph node	2.0	0.2	2.4	2.0
Colorectal	0.3	3.2	0.5	0.1
Stomach	3.4	0.1	2.2	0.1
Small intestine	3.5	0.6	1.3	0.7
Colon ca. SW480	1.6	0.7	2.4	2.0
Colon ca.* SW620(SW480 met)	0.0	0.0	0.0	0.0
Colon ca. HT29	0.7	0.7	0.6	0.8
Colon ca. HCT-116	0.3	0.0	0.0	0.1
Colon ca. CaCo-2	8.6	14.3	9.7	7.4
Colon ca. tissue(ODO3866)	2.6	2.5	2.6	1.4
Colon ca. HCC-2998	1.0	0.4	2.4	1.2
Gastric ca.* (liver met) NCI-N87	0.9	0.3	2.4	0.6
Bladder	0.9	2.5	2.3	0.4
Trachea	0.8	0.3	0.0	0.2
Kidney	0.8	0.5	0.0	0.0
Kidney (fetal)	2.8	1.4	2.5	1.3
Renal ca. 786-0	11.2	6.4	19.9	9.5
Renal ca. A498	13.1	4.3	13.2	7.2
Renal ca. RXF 393	21.5	7.2	21.3	26.1
Renal ca. ACHN	10.1	5.1	7.6	7.5
Renal ca. UO-31	10.2	3.3	13.8	9.5
Renal ca. TK-10	0.0	0.0	0.0	0.0

Liver	0.0	0.0	0.0	0.0
Liver (fetal)	0.1	0.0	0.0	0.0
Liver ca. (hepatoblast) HepG2	0.2	0.2	0.0	0.4
Lung	0.4	0.1	0.2	0.0
Lung (fetal)	0.3	0.3	0.0	0.7
Lung ca. (small cell) LX-1	0.0	0.0	0.0	0.0
Lung ca. (small cell) NCI-H69	3.1	11.6	5.4	11.2
Lung ca. (s.cell var.) SHP-77	2.4	1.7	0.0	0.0
Lung ca. (large cell)NCI-H460	18.6	2.6	26.1	12.9
Lung ca. (non-sm. cell) A549	0.4	0.1	0.6	0.2
Lung ca. (non-s.cell) NCI-H23	1.4	2.1	1.2	0.1
Lung ca. (non-s.cell) HOP-62	9.5	3.9	16.0	6.8
Lung ca. (non-s.cl) NCI-H522	28.1	36.9	15.3	5.8
Lung ca. (squam.) SW 900	0.6	0.1	0.2	0.1
Lung ca. (squam.) NCI-H596	16.5	8.0	19.2	12.3
Mammary gland	0.7	0.5	0.5	0.2
Breast ca.* (pl.ef) MCF-7	5.0	8.8	5.1	2.1
Breast ca.* (pl.ef) MDA-MB-231	2.4	0.3	0.5	0.4
Breast ca.* (pl.ef) T47D	53.6	26.1	1.9	1.1
Breast ca. BT-549	0.0	0.0	0.0	0.0
Breast ca. MDA-N	0.8	1.1	1.5	1.1
Ovary	0.8	2.8	0.3	0.0
Ovarian ca. OVCAR-3	58.6	19.3	26.8	20.0
Ovarian ca. OVCAR-4	2.4	0.4	3.1	2.0
Ovarian ca. OVCAR-5	0.0	0.0	0.0	0.0
Ovarian ca. OVCAR-8	8.7	6.7	1.7	2.8
Ovarian ca. IGROV-	3.1	1.5	0.0	0.4

1				
Ovarian ca.* (ascites) SK-OV-3	27.9	6.7	22.2	0.0
Uterus	2.4	0.4	1.2	0.9
Placenta	8.1	4.4	7.7	4.1
Prostate	2.1	0.1	0.0	0.0
Prostate ca.* (bone met)PC-3	0.7	1.1	0.0	0.0
Testis	4.5	1.1	0.0	0.1
Melanoma Hs688(A).T	10.0	20.4	12.8	7.5
Melanoma* (met) Hs688(B).T	12.5	18.9	12.0	4.2
Melanoma UACC- 62	1.2	0.3	0.4	0.3
Melanoma M14	13.7	2.1	14.4	7.8
Melanoma LOX IMVI	1.2	1.2	0.0	0.0
Melanoma* (met) SK-MEL-5	3.7	4.5	3.8	1.8
Adipose	3.6	4.5	12.9	0.6

Table NF. Panel 2D

Tissue Name	Rel. Exp.(%) Ag2674, Run 162455917	Rel. Exp.(%) Ag2820, Run 163578010	Rel. Exp.(%) Ag2820, Run 165910586	Tissue Name	Rel. Exp.(%) Ag2674, Run 162455917	Rel. Exp.(%) Ag2820, Run 163578010	Rel. Exp.(%) Ag2820, Run 165910586
Normal Colon	47.6	12.4	15.7	Kidney Margin 8120608	6.9	1.7	3.7
CC Well to Mod Diff (ODO3866)	8.4	7.2	7.4	Kidney Cancer 8120613	0.5	0.0	0.0
CC Margin (ODO3866)	8.0	0.8	0.4	Kidney Margin 8120614	2.8	1.6	0.0
CC Gr.2 rectosigmoid (ODO3868)	5.4	3.8	2.3	Kidney Cancer 9010320	22.4	39.5	36.1
CC Margin (ODO3868)	12.4	2.2	1.2	Kidney Margin 9010321	14.1	22.5	11.6
CC Mod Diff (ODO3920)	0.4	0.7	0.0	Normal Uterus	7.1	4.1	7.0

CC Margin (ODO3920)	12.2	1.6	1.4	Uterus Cancer 064011	38.4	5.5	2.3
CC Gr.2 ascend colon (ODO3921)	3.8	2.9	3.6	Normal Thyroid	13.9	4.7	1.1
CC Margin (ODO3921)	8.9	1.3	0.0	Thyroid Cancer 064010	30.4	36.3	40.9
CC from Partial Hepatectomy (ODO4309) Mets	6.0	12.3	12.5	Thyroid Cancer A302152	8.3	5.8	2.8
Liver Margin (ODO4309)	0.4	0.4	0.0	Thyroid Margin A302153	88.3	10.0	7.2
Colon mets to lung (OD04451- 01)	1.4	1.5	1.1	Normal Breast	26.4	9.5	11.3
Lung Margin (OD04451- 02)	0.7	0.0	0.8	Breast Cancer (OD04566)	2.0	0.7	0.8
Normal Prostate 6546-1	14.1	6.3	2.0	Breast Cancer (OD04590- 01)	13.7	4.0	2.9
Prostate Cancer (OD04410)	26.8	4.9	4.1	Breast Cancer Mets (OD04590- 03)	55.1	32.5	15.9
Prostate Margin (OD04410)	27.0	6.0	1.9	Breast Cancer Metastasis (OD04655- 05)	24.8	12.2	2.9
Prostate Cancer (OD04720- 01)	18.8	3.2	1.2	Breast Cancer 064006	11.2	7.5	5.5
Prostate Margin (OD04720- 02)	41.2	8.0	3.9	Breast Cancer 1024	11.1	1.8	1.3
Normal Lung	16.0	13.4	11.8	Breast Cancer	11.8	3.5	1.2



061010				9100266			
Lung Met to Muscle (ODO4286)	25.5	64.2	39.2	Breast Margin 9100265	13.2	4.9	1.7
Muscle Margin (ODO4286)	14.1	1.3	1.1	Breast Cancer A209073	19.2	3.5	1.7
Lung Malignant Cancer (OD03126)	44.8	66.9	57.8	Breast Margin A2090734	25.3	0.6	2.0
Lung Margin (OD03126)	11.7	10.6	5.9	Normal Liver	1.7	1.2	0.3
Lung Cancer (OD04404)	13.7	10.4	11.6	Liver Cancer 064003	0.5	0.0	0.0
Lung Margin (OD04404)	11.4	10.7	14.4	Liver Cancer 1025	0.0	0.0	0.0
Lung Cancer (OD04565)	13.1	8.5	4.5	Liver Cancer 1026	0.7	0.0	0.0
Lung Margin (OD04565)	3.1	5.3	6.2	Liver Cancer 6004-T	0.5	0.0	0.0
Lung Cancer (OD04237-01)	7.4	13.6	4.5	Liver Tissue 6004-N	0.6	1.0	0.3
Lung Margin (OD04237-02)	4.8	5.3	3.8	Liver Cancer 6005-T	1.1	0.0	0.0
Ocular Mel Met to Liver (ODO4310)	0.9	0.0	0.0	Liver Tissue 6005-N	0.0	0.0	0.0
Liver Margin (ODO4310)	5.0	0.0	0.3	Normal Bladder	26.1	14.7	12.7
Melanoma Mets to Lung (OD04321)	29.7	57.4	31.6	Bladder Cancer 1023	6.0	9.2	2.0
Lung Margin (OD04321)	4.3	7.0	3.5	Bladder Cancer A302173	6.0	3.9	2.3
Normal Kidney	27.7	18.9	14.4	Bladder Cancer (OD04718-01)	41.8	89.5	82.4

Kidney Ca, Nuclear grade 2 (OD04338)	2.9	5.6	2.9	Bladder Normal Adjacent (OD04718- 03)	22.4	3.5	3.9
Kidney Margin (OD04338)	11.8	10.8	9.0	Normal Ovary	10.1	2.1	0.6
Kidney Ca Nuclear grade 1/2 (OD04339)	48.3	82.4	67.8	Ovarian Cancer 064008	100.0	36.3	100.0
Kidney Margin (OD04339)	15.9	17.7	8.8	Ovarian Cancer (OD04768- 07)	0.3	0.0	0.4
Kidney Ca, Clear cell type (OD04340)	0.8	0.0	0.3	Ovary Margin (OD04768- 08)	8.2	6.9	4.4
Kidney Margin (OD04340)	21.6	13.9	8.0	Normal Stomach	5.7	2.2	1.9
Kidney Ca, Nuclear grade 3 (OD04348)	33.4	84.7	58.2	Gastric Cancer 9060358	7.2	3.0	2.8
Kidney Margin (OD04348)	12.9	4.6	11.1	Stomach Margin 9060359	4.9	0.7	1.5
Kidney Cancer (OD04622- 01)	1.4	0.0	4.6	Gastric Cancer 9060395	6.5	1.9	1.8
Kidney Margin (OD04622- 03)	7.3	3.9	1.1	Stomach Margin 9060394	7.2	2.2	2.3
Kidney Cancer (OD04450- 01)	84.7	100.0	78.5	Gastric Cancer 9060397	46.7	22.7	28.5
Kidney Margin (OD04450- 03)	19.9	12.0	6.9	Stomach Margin 9060396	4.7	0.7	0.0
Kidney Cancer	12.7	4.9	4.2	Gastric Cancer	5.6	9.2	6.5

8120607			064005			
---------	--	--	--------	--	--	--

Table NG. Panel 4D

<b>Tissue Name</b>	<b>Rel. Exp.(%) Ag1479, Run 162599612</b>	<b>Rel. Exp.(%) Ag2674, Run 160645450</b>	<b>Rel. Exp.(%) Ag2820, Run 162350531</b>	<b>Rel. Exp.(%) Ag2820, Run 164329602</b>
Secondary Th1 act	0.3	0.0	0.0	0.0
Secondary Th2 act	0.0	0.0	0.0	0.5
Secondary Tr1 act	0.0	0.0	0.0	0.3
Secondary Th1 rest	0.0	0.0	0.0	0.0
Secondary Th2 rest	0.0	0.0	0.0	0.0
Secondary Tr1 rest	0.0	0.0	0.0	0.0
Primary Th1 act	0.0	0.0	0.0	0.0
Primary Th2 act	0.0	0.0	0.0	0.0
Primary Tr1 act	0.0	0.0	0.0	0.0
Primary Th1 rest	0.0	0.5	0.0	0.0
Primary Th2 rest	0.0	0.0	0.0	0.0
Primary Tr1 rest	0.0	0.0	0.0	0.0
CD45RA CD4 lymphocyte act	1.8	1.0	1.6	0.8
CD45RO CD4 lymphocyte act	0.0	0.0	0.0	0.0
CD8 lymphocyte act	0.0	0.0	0.0	0.0
Secondary CD8 lymphocyte rest	0.0	0.0	0.0	0.0
Secondary CD8 lymphocyte act	0.0	0.0	0.0	0.0
CD4 lymphocyte none	0.0	0.0	0.0	0.0
2ry Th1/Th2/Tr1_anti- CD95 CH11	0.0	0.0	0.0	0.0
LAK cells rest	0.0	0.0	0.0	0.0
LAK cells IL-2	0.0	0.0	0.3	0.0
LAK cells IL-2+IL-12	0.0	0.0	0.0	0.7
LAK cells IL-2+IFN gamma	0.0	0.0	0.0	0.0
LAK cells IL-2+ IL-18	0.0	0.0	0.0	0.0
LAK cells PMA/ionomycin	0.0	0.0	0.0	0.5
NK Cells IL-2 rest	0.0	0.0	0.0	0.0
Two Way MLR 3 day	0.0	0.0	0.0	0.0
Two Way MLR 5 day	0.0	0.0	0.0	0.0
Two Way MLR 7 day	0.0	0.0	0.0	0.0
PBMC rest	0.0	0.0	0.0	0.0
PBMC PWM	0.0	0.0	0.0	0.0

PBMC PHA-L	0.0	0.0	0.0	0.0
Ramos (B cell) none	0.0	0.0	0.0	0.0
Ramos (B cell) ionomycin	0.0	0.0	0.0	0.0
B lymphocytes PWM	0.0	0.0	0.3	2.5
B lymphocytes CD40L and IL-4	0.2	0.4	0.0	0.0
EOL-1 dbcAMP	0.2	0.2	0.3	0.7
EOL-1 dbcAMP PMA/ionomycin	0.1	0.2	0.9	0.0
Dendritic cells none	0.0	0.0	0.0	0.0
Dendritic cells LPS	0.0	0.0	0.0	0.0
Dendritic cells anti-CD40	0.0	0.0	0.0	0.0
Monocytes rest	0.0	0.0	0.0	0.0
Monocytes LPS	0.0	0.0	0.0	0.0
Macrophages rest	0.0	0.0	0.0	0.0
Macrophages LPS	0.0	0.0	0.0	0.0
HUVEC none	23.0	17.7	0.0	0.0
HUVEC starved	25.0	26.1	0.0	0.0
HUVEC IL-1beta	8.1	7.1	0.0	0.0
HUVEC IFN gamma	14.8	13.8	0.0	0.3
HUVEC TNF alpha + IFN gamma	8.1	6.7	0.0	0.0
HUVEC TNF alpha + IL4	12.0	10.2	0.0	0.0
HUVEC IL-11	8.5	7.0	0.0	0.0
Lung Microvascular EC none	11.1	14.2	0.0	0.0
Lung Microvascular EC TNFalpha + IL-1beta	9.3	11.0	0.0	0.2
Microvascular Dermal EC none	100.0	75.3	0.0	0.0
Microvascular Dermal EC TNFalpha + IL-1beta	29.7	26.8	0.0	0.0
Bronchial epithelium TNFalpha + IL1beta	0.2	1.3	2.4	19.9
Small airway epithelium none	2.2	1.1	1.0	1.7
Small airway epithelium TNFalpha + IL-1beta	0.3	0.2	0.0	0.0
Coronary artery SMC rest	8.3	8.0	1.9	2.6
Coronary artery SMC	4.6	3.1	3.0	1.2

TNFalpha + IL-1beta				
Astrocytes rest	85.9	70.2	<b>100.0</b>	<b>100.0</b>
Astrocytes TNFalpha + IL-1beta	59.0	<b>100.0</b>	71.7	65.5
KU-812 (Basophil) rest	0.0	0.3	0.0	0.0
KU-812 (Basophil) PMA/ionomycin	0.0	0.0	0.0	0.0
CCD1106 (Keratinocytes) none	19.8	17.2	35.6	70.2
CCD1106 (Keratinocytes) TNFalpha + IL-1beta	1.7	1.3	13.4	29.3
Liver cirrhosis	0.0	0.5	0.3	0.0
Lupus kidney	1.8	2.9	6.2	8.1
NCI-H292 none	0.0	0.0	0.0	0.0
NCI-H292 IL-4	0.0	0.0	0.3	0.4
NCI-H292 IL-9	0.0	0.0	0.0	0.0
NCI-H292 IL-13	0.0	0.0	0.0	0.0
NCI-H292 IFN gamma	0.0	0.0	0.0	0.0
HPAEC none	15.1	12.2	0.0	0.0
HPAEC TNF alpha + IL-1 beta	6.2	7.5	0.6	0.0
Lung fibroblast none	0.9	0.4	0.0	0.4
Lung fibroblast TNF alpha + IL-1 beta	0.6	0.0	0.0	0.0
Lung fibroblast IL-4	2.1	2.9	1.7	3.7
Lung fibroblast IL-9	1.2	0.5	1.2	2.0
Lung fibroblast IL-13	1.2	0.9	1.6	3.3
Lung fibroblast IFN gamma	2.1	1.9	2.3	0.2
Dermal fibroblast CCD1070 rest	10.5	9.8	10.3	8.4
Dermal fibroblast CCD1070 TNF alpha	11.6	4.6	10.0	11.3
Dermal fibroblast CCD1070 IL-1 beta	4.9	2.2	4.5	3.8
Dermal fibroblast IFN gamma	1.2	1.7	0.3	1.6
Dermal fibroblast IL-4	28.3	27.9	12.1	13.4
IBD Colitis 2	0.7	1.6	0.3	0.0
IBD Crohn's	1.6	0.4	0.8	3.7
Colon	8.6	7.6	1.7	1.9
Lung	2.0	2.9	3.8	6.3
Thymus	7.0	13.7	4.1	4.4

Kidney	17.0	27.5	13.0	20.2
--------	------	------	------	------

**CNS\_neurodegeneration\_v1.0 Summary:** Ag2674 While no association between expression of the SC145665404\_A gene and Alzheimer's disease is apparent in this panel, the profile here confirms expression of this gene in the brain. See Panel 1.3D for discussion of potential utility of this gene in the brain.

5           **Panel 1.3D Summary:** Ag1479/2674/Ag2820 The SC145665404\_A gene encodes a protein that is homologous to ten-m3 and may be involved in brain compartmentation. In multiple experiments with different probe and primer sets highest expression of this gene is seen in the brain and in brain cancer cell lines. Thus, inhibitors of this gene product could have utility in diseases involving neurite outgrowth or organization, such as neurodegenerative  
10       diseases.

In addition to expression in brain cancer cell lines, there is substantial expression in other samples derived from cancer cell lines, such as breast cancer, lung cancer, and ovarian cancer. Thus, the expression of this gene could be used to distinguish these samples from other samples in the panel. Moreover, therapeutic modulation of this gene, through the use of small  
15       molecule drugs, antibodies or protein therapeutics might be of use in the treatment of brain cancer, lung cancer, breast cancer or ovarian cancer.

This gene is also moderately expressed metabolic tissues including adrenal, thyroid, pituitary, fetal heart, adult and fetal skeletal muscle, and adipose. Thus, this gene product may be an antibody target for the treatment of any or all diseases in these tissues, including obesity  
20       and diabetes.

**Panel 2D Summary:** Ag2674/2820 The expression of the SC145665404\_A gene was assessed in three independent runs in panel 2D using two different probe/primer sets. The highest expression of this gene is generally associated with kidney cancers. Of particular note is the consistent absence of expression in normal kidney tissue adjacent to malignant kidney.  
25       In addition, there is substantial expression associated with ovarian cancer, bladder cancer and lung cancer. Thus, the expression of this gene could be used to distinguish the above listed malignant tissue from other tissues in the panel. Particularly, the expression of this gene could be used to distinguish malignant kidney tissue from normal kidney. Moreover, therapeutic modulation of this gene, through the use of small molecule drugs, antibodies or protein  
30       therapeutics might be of benefit in the treatment of kidney cancer, ovarian cancer, bladder cancer or lung cancer.

**Panel 4D Summary:** Ag1479/Ag2674/Ag2820 The expression of the SC145665404\_A transcript is highest in astrocytes and microvascular dermal endothelial cells (CTs=29-30), with low but significant expression in keratinocytes, and dermal fibroblasts. Expression is not modulated by any treatment, suggesting that this protein may be important in normal homeostasis. Thus, this transcript or the protein it encodes could be used to identify the tissues and cells in which it is expressed.

#### O. CG55910-01: ACYL-COA DESATURASE 1 (NOV10)

Expression of gene CG55910-01 was assessed using the primer-probe sets Ag2839 and Ag2031, described in Tables OA and OB. Results of the RTQ-PCR runs are shown in Tables OC, OD, OE, OF, OG and OH.

Table OA. Probe Name Ag2839

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-ggcttccataattaccatcaca-3'	1067	326
Probe	TET-5'-cctttccctttgactactctgcgagtg-3'-TAMRA	1089	327
Reverse	5'-gcacatgaaatcaatgaacca-3'	1145	328

Table OB. Probe Name Ag2031

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-ggcttccataattaccatcaca-3'	1067	329
Probe	TET-5'-cctttccctttgactactctgcgagtg-3'-TAMRA	1089	330
Reverse	5'-gcacatgaaatcaatgaacca-3'	1145	331

Table OC. CNS\_neurodegeneration\_v1.0

Tissue Name	Rel. Exp.(%) Ag2839, Run 209052444	Tissue Name	Rel. Exp.(%) Ag2839, Run 209052444
AD 1 Hippo	17.2	Control (Path) 3 Temporal Ctx	7.8
AD 2 Hippo	43.5	Control (Path) 4 Temporal Ctx	25.2
AD 3 Hippo	8.4	AD 1 Occipital Ctx	15.1
AD 4 Hippo	11.9	AD 2 Occipital Ctx (Missing)	0.0
AD 5 hippo	54.3	AD 3 Occipital Ctx	7.3
AD 6 Hippo	55.5	AD 4 Occipital Ctx	23.8
Control 2 Hippo	47.0	AD 5 Occipital Ctx	18.0
Control 4 Hippo	15.7	AD 6 Occipital Ctx	49.0
Control (Path) 3 Hippo	7.7	Control 1 Occipital Ctx	4.4
AD 1 Temporal Ctx	16.6	Control 2 Occipital	75.8

		Ctx	
AD 2 Temporal Ctx	44.4	Control 3 Occipital Ctx	18.0
AD 3 Temporal Ctx	6.7	Control 4 Occipital Ctx	12.2
AD 4 Temporal Ctx	28.1	Control (Path) 1 Occipital Ctx	73.7
AD 5 Inf Temporal Ctx	100.0	Control (Path) 2 Occipital Ctx	9.9
AD 5 SupTemporal Ctx	69.7	Control (Path) 3 Occipital Ctx	3.7
AD 6 Inf Temporal Ctx	44.1	Control (Path) 4 Occipital Ctx	8.4
AD 6 Sup Temporal Ctx	43.5	Control 1 Parietal Ctx	11.5
Control 1 Temporal Ctx	11.7	Control 2 Parietal Ctx	36.1
Control 2 Temporal Ctx	53.2	Control 3 Parietal Ctx	21.6
Control 3 Temporal Ctx	17.3	Control (Path) 1 Parietal Ctx	64.6
Control 4 Temporal Ctx	14.8	Control (Path) 2 Parietal Ctx	23.8
Control (Path) 1 Temporal Ctx	58.6	Control (Path) 3 Parietal Ctx	6.5
Control (Path) 2 Temporal Ctx	32.8	Control (Path) 4 Parietal Ctx	31.4

Table OD. Panel 1.3D

Tissue Name	Rel. Exp.(%) Ag2031, Run 152479705	Rel. Exp.(%) Ag2839, Run 164023720	Tissue Name	Rel. Exp.(%) Ag2031, Run 152479705	Rel. Exp.(%) Ag2839, Run 164023720
Liver adenocarcinoma	5.2	7.4	Kidney (fetal)	2.0	1.6
Pancreas	5.8	2.1	Renal ca. 786-0	0.0	0.0
Pancreatic ca. CAPAN 2	0.5	0.3	Renal ca. A498	0.4	0.7
Adrenal gland	12.9	6.9	Renal ca. RXF 393	0.0	0.0
Thyroid	8.5	4.8	Renal ca. ACHN	0.7	0.4
Salivary gland	1.6	0.5	Renal ca. UO-31	0.5	0.1
Pituitary gland	11.5	6.4	Renal ca. TK-10	0.0	0.0



Brain (fetal)	15.3	9.1	Liver	0.3	0.0
Brain (whole)	45.7	29.7	Liver (fetal)	0.2	0.1
Brain (amygdala)	44.1	27.5	Liver ca. (hepatoblast) HepG2	0.0	0.0
Brain (cerebellum)	19.5	30.1	Lung	2.7	2.3
Brain (hippocampus)	100.0	39.2	Lung (fetal)	2.3	1.1
Brain (substantia nigra)	17.8	10.3	Lung ca. (small cell) LX-1	0.3	0.1
Brain (thalamus)	32.1	25.5	Lung ca. (small cell) NCI-H69	0.9	0.4
Cerebral Cortex	89.5	100.0	Lung ca. (s.cell var.) SHP-77	0.0	0.0
Spinal cord	39.2	51.1	Lung ca. (large cell) NCI-H460	0.6	0.3
glio/astro U87-MG	1.1	2.6	Lung ca. (non- sm. cell) A549	0.5	0.5
glio/astro U-118- MG	1.4	0.3	Lung ca. (non- s.cell) NCI- H23	1.8	1.1
astrocytoma SW1783	0.3	0.6	Lung ca. (non- s.cell) HOP-62	1.0	0.7
neuro*; met SK-N- AS	1.4	0.4	Lung ca. (non- s.cl) NCI- H522	1.3	0.8
astrocytoma SF- 539	1.2	1.0	Lung ca. (squam.) SW 900	1.5	1.1
astrocytoma SNB- 75	2.7	0.8	Lung ca. (squam.) NCI- H596	0.0	0.2
glioma SNB-19	12.6	22.2	Mammary gland	1.2	0.9
glioma U251	3.0	2.1	Breast ca.* (pl.ef) MCF-7	2.1	4.0
glioma SF-295	0.6	0.4	Breast ca.* (pl.ef) MDA- MB-231	2.3	0.5
Heart (fetal)	1.6	1.2	Breast ca.* (pl.ef) T47D	0.0	0.0
Heart	0.6	1.2	Breast ca. BT- 549	1.3	0.5
Skeletal muscle	3.4	4.1	Breast ca.	0.0	0.0

(fetal)			MDA-N		
Skeletal muscle	0.1	0.2	Ovary	23.3	30.6
Bone marrow	0.2	0.0	Ovarian ca. OVCAR-3	8.4	7.4
Thymus	0.7	3.6	Ovarian ca. OVCAR-4	2.3	0.9
Spleen	1.1	0.5	Ovarian ca. OVCAR-5	1.3	1.0
Lymph node	0.6	0.2	Ovarian ca. OVCAR-8	2.1	2.0
Colorectal	0.6	0.5	Ovarian ca. IGROV-1	0.4	0.4
Stomach	2.6	0.8	Ovarian ca.* (ascites) SK- OV-3	1.4	0.8
Small intestine	2.9	1.2	Uterus	1.8	0.5
Colon ca. SW480	3.6	0.9	Placenta	0.7	0.2
Colon ca.* SW620(SW480 met)	0.6	0.7	Prostate	1.5	0.5
Colon ca. HT29	0.0	0.0	Prostate ca.* (bone met)PC- 3	0.6	0.5
Colon ca. HCT- 116	1.5	1.6	Testis	11.0	6.7
Colon ca. CaCo-2	0.6	0.5	Melanoma Hs688(A).T	1.2	0.3
Colon ca. tissue(ODO3866)	0.2	0.5	Melanoma* (met) Hs688(B).T	0.8	0.3
Colon ca. HCC- 2998	0.1	0.0	Melanoma UACC-62	0.2	0.6
Gastric ca.* (liver met) NCI-N87	4.1	2.4	Melanoma M14	0.2	0.2
Bladder	2.0	4.5	Melanoma LOX IMVI	0.2	0.1
Trachea	2.9	2.9	Melanoma* (met) SK- MEL-5	1.4	0.5
Kidney	2.5	8.8	Adipose	0.5	0.4

Table OE. Panel 2D

Tissue Name	Rel. Exp.(%) Ag2839, Run 162559077	Tissue Name	Rel. Exp.(%) Ag2839, Run 162559077
Normal Colon	14.1	Kidney Margin	21.2

		8120608	
CC Well to Mod Diff (ODO3866)	1.6	Kidney Cancer 8120613	1.1
CC Margin (ODO3866)	2.2	Kidney Margin 8120614	27.7
CC Gr.2 rectosigmoid (ODO3868)	0.6	Kidney Cancer 9010320	13.6
CC Margin (ODO3868)	3.0	Kidney Margin 9010321	25.7
CC Mod Diff (ODO3920)	0.6	Normal Uterus	3.0
CC Margin (ODO3920)	3.5	Uterus Cancer 064011	12.7
CC Gr.2 ascend colon (ODO3921)	3.6	Normal Thyroid	60.7
CC Margin (ODO3921)	2.3	Thyroid Cancer 064010	34.4
CC from Partial Hepatectomy (ODO4309) Mets	3.4	Thyroid Cancer A302152	41.2
Liver Margin (ODO4309)	0.5	Thyroid Margin A302153	35.4
Colon mets to lung (OD04451-01)	11.0	Normal Breast	7.3
Lung Margin (OD04451-02)	11.3	Breast Cancer (OD04566)	0.3
Normal Prostate 6546-1	44.4	Breast Cancer (OD04590-01)	2.6
Prostate Cancer (OD04410)	10.0	Breast Cancer Mets (OD04590-03)	2.4
Prostate Margin (OD04410)	18.3	Breast Cancer Metastasis (OD04655-05)	11.6
Prostate Cancer (OD04720-01)	13.8	Breast Cancer 064006	3.9
Prostate Margin (OD04720-02)	28.1	Breast Cancer 1024	5.9
Normal Lung 061010	35.1	Breast Cancer 9100266	31.4
Lung Met to Muscle (ODO4286)	1.1	Breast Margin 9100265	12.9
Muscle Margin (ODO4286)	2.0	Breast Cancer A209073	5.8
Lung Malignant Cancer (OD03126)	6.6	Breast Margin A2090734	4.1
Lung Margin (OD03126)	20.6	Normal Liver	1.0
Lung Cancer (OD04404)	15.6	Liver Cancer 064003	0.1
Lung Margin (OD04404)	11.0	Liver Cancer 1025	0.5

Lung Cancer (OD04565)	3.1	Liver Cancer 1026	1.8
Lung Margin (OD04565)	4.6	Liver Cancer 6004-T	1.1
Lung Cancer (OD04237-01)	20.4	Liver Tissue 6004-N	0.4
Lung Margin (OD04237-02)	16.5	Liver Cancer 6005-T	0.7
Ocular Mel Met to Liver (ODO4310)	0.6	Liver Tissue 6005-N	0.6
Liver Margin (ODO4310)	0.5	Normal Bladder	42.0
Melanoma Mets to Lung (OD04321)	8.1	Bladder Cancer 1023	1.1
Lung Margin (OD04321)	20.9	Bladder Cancer A302173	37.9
Normal Kidney	87.7	Bladder Cancer (OD04718-01)	35.8
Kidney Ca, Nuclear grade 2 (OD04338)	3.7	Bladder Normal Adjacent (OD04718-03)	9.7
Kidney Margin (OD04338)	33.0	Normal Ovary	60.3
Kidney Ca Nuclear grade 1/2 (OD04339)	24.1	Ovarian Cancer 064008	20.4
Kidney Margin (OD04339)	33.9	Ovarian Cancer (OD04768-07)	100.0
Kidney Ca, Clear cell type (OD04340)	7.1	Ovary Margin (OD04768-08)	4.4
Kidney Margin (OD04340)	52.5	Normal Stomach	8.2
Kidney Ca, Nuclear grade 3 (OD04348)	1.8	Gastric Cancer 9060358	4.1
Kidney Margin (OD04348)	29.1	Stomach Margin 9060359	10.0
Kidney Cancer (OD04622-01)	2.0	Gastric Cancer 9060395	9.3
Kidney Margin (OD04622-03)	9.5	Stomach Margin 9060394	4.5
Kidney Cancer (OD04450-01)	83.5	Gastric Cancer 9060397	3.2
Kidney Margin (OD04450-03)	62.9	Stomach Margin 9060396	1.6
Kidney Cancer 8120607	15.3	Gastric Cancer 064005	4.8

Table OF. Panel 4D

Tissue Name	Rel. Exp.(%)	Rel. Exp.(%)	Tissue Name	Rel. Exp.(%)	Rel. Exp.(%)
-------------	--------------	--------------	-------------	--------------	--------------

	<b>Ag2031, Run 152784562</b>	<b>Ag2839, Run 162294682</b>		<b>Ag2031, Run 152784562</b>	<b>Ag2839, Run 162294682</b>
Secondary Th1 act	3.0	1.1	HUVEC IL-1beta	12.2	8.1
Secondary Th2 act	1.8	1.0	HUVEC IFN gamma	22.7	21.0
Secondary Tr1 act	2.1	1.2	HUVEC TNF alpha + IFN gamma	4.0	3.9
Secondary Th1 rest	0.5	0.2	HUVEC TNF alpha + IL4	7.2	6.6
Secondary Th2 rest	0.2	0.3	HUVEC IL-11	13.7	15.6
Secondary Tr1 rest	0.2	0.0	Lung Microvascular EC none	22.5	39.0
Primary Th1 act	1.6	1.0	Lung Microvascular EC TNFalpha + IL- 1beta	10.8	9.6
Primary Th2 act	0.5	0.5	Microvascular Dermal EC none	63.7	86.5
Primary Tr1 act	0.8	0.6	Microvascular Dermal EC TNFalpha + IL- 1beta	17.9	19.8
Primary Th1 rest	3.1	2.5	Bronchial epithelium TNFalpha + IL1beta	2.6	30.8
Primary Th2 rest	0.3	0.6	Small airway epithelium none	10.4	9.9
Primary Tr1 rest	0.7	0.6	Small airway epithelium TNFalpha + IL- 1beta	<b>100.0</b>	<b>100.0</b>
CD45RA CD4 lymphocyte act	5.2	2.5	Coronary artery SMC rest	14.1	18.2
CD45RO CD4 lymphocyte act	1.1	0.6	Coronary artery SMC TNFalpha + IL-1beta	11.7	6.9
CD8 lymphocyte act	1.8	2.1	Astrocytes rest	77.9	79.0
Secondary CD8 lymphocyte rest	0.5	0.7	Astrocytes TNFalpha + IL- 1beta	61.6	39.0
Secondary CD8 lymphocyte act	1.6	2.3	KU-812 (Basophil) rest	0.0	0.0

CD4 lymphocyte none	0.1	0.2	KU-812 (Basophil) PMA/ionomycin	0.1	0.4
2ry Th1/Th2/Tr1_anti-CD95 CH11	0.3	0.5	CCD1106 (Keratinocytes) none	10.8	17.4
LAK cells rest	1.0	1.2	CCD1106 (Keratinocytes) TNFalpha + IL-1beta	2.0	14.4
LAK cells IL-2	5.0	6.3	Liver cirrhosis	3.1	5.0
LAK cells IL-2+IL-12	0.8	0.9	Lupus kidney	3.3	3.4
LAK cells IL-2+IFN gamma	1.3	1.6	NCI-H292 none	40.3	53.6
LAK cells IL-2+IL-18	1.0	1.6	NCI-H292 IL-4	75.3	48.0
LAK cells PMA/ionomycin	0.1	0.2	NCI-H292 IL-9	69.3	68.3
NK Cells IL-2 rest	3.5	3.8	NCI-H292 IL-13	36.3	31.0
Two Way MLR 3 day	1.1	1.4	NCI-H292 IFN gamma	40.6	28.3
Two Way MLR 5 day	1.0	0.5	HPAEC none	40.9	41.5
Two Way MLR 7 day	0.4	0.3	HPAEC TNF alpha + IL-1 beta	15.6	13.5
PBMC rest	0.4	0.8	Lung fibroblast none	5.5	4.2
PBMC PWM	1.3	1.3	Lung fibroblast TNF alpha + IL-1 beta	2.6	2.2
PBMC PHA-L	2.7	4.1	Lung fibroblast IL-4	8.6	9.8
Ramos (B cell) none	2.1	1.3	Lung fibroblast IL-9	5.6	6.0
Ramos (B cell) ionomycin	5.6	11.5	Lung fibroblast IL-13	4.7	3.7
B lymphocytes PWM	1.1	2.4	Lung fibroblast IFN gamma	8.8	10.0
B lymphocytes CD40L and IL-4	0.8	0.3	Dermal fibroblast CCD1070 rest	14.8	14.0
EOL-1 dbcAMP	9.9	11.3	Dermal fibroblast CCD1070 TNF alpha	17.6	19.2
EOL-1 dbcAMP PMA/ionomycin	5.0	4.5	Dermal fibroblast CCD1070 IL-1 beta	5.0	3.4

Dendritic cells none	0.2	0.1	Dermal fibroblast IFN gamma	9.0	5.2
Dendritic cells LPS	1.9	1.9	Dermal fibroblast IL-4	28.5	21.0
Dendritic cells anti-CD40	0.7	0.9	IBD Colitis 2	0.7	0.9
Monocytes rest	0.6	0.6	IBD Crohn's	1.4	1.6
Monocytes LPS	0.1	0.0	Colon	13.3	9.2
Macrophages rest	0.6	0.4	Lung	18.3	14.2
Macrophages LPS	0.0	0.1	Thymus	89.5	90.1
HUVEC none	29.3	33.7	Kidney	20.3	24.3
HUVEC starved	59.9	65.1			

Table OG. Panel 5D

Tissue Name	Rel. Exp.(%) Ag2839, Run 223676497	Tissue Name	Rel. Exp.(%) Ag2839, Run 223676497
97457_Patient-02go_adipose	3.6	94709_Donor 2 AM - A_adipose	46.0
97476_Patient-07sk_skeletal muscle	3.5	94710_Donor 2 AM - B_adipose	22.2
97477_Patient-07ut_uterus	3.3	94711_Donor 2 AM - C_adipose	23.2
97478_Patient-07pl_placenta	3.3	94712_Donor 2 AD - A_adipose	17.9
97481_Patient-08sk_skeletal muscle	2.6	94713_Donor 2 AD - B_adipose	30.4
97482_Patient-08ut_uterus	2.5	94714_Donor 2 AD - C_adipose	13.9
97483_Patient-08pl_placenta	2.7	94742_Donor 3 U - A_Mesenchymal Stem Cells	3.7
97486_Patient-09sk_skeletal muscle	0.8	94743_Donor 3 U - B_Mesenchymal Stem Cells	2.7
97487_Patient-09ut_uterus	2.5	94730_Donor 3 AM - A_adipose	48.0
97488_Patient-09pl_placenta	2.3	94731_Donor 3 AM - B_adipose	20.4
97492_Patient-10ut_uterus	3.7	94732_Donor 3 AM - C_adipose	25.0
97493_Patient-10pl_placenta	6.1	94733_Donor 3 AD - A_adipose	21.8
97495_Patient-11go_adipose	5.2	94734_Donor 3 AD - B_adipose	11.9
97496_Patient-11sk_skeletal muscle	1.3	94735_Donor 3 AD - C_adipose	14.8

97497_Patient-11ut_uterus	6.7	77138_Liver_HepG2untreated	0.7
97498_Patient-11pl_placenta	4.2	73556_Heart_Cardiac stromal cells (primary)	39.5
97500_Patient-12go_adipose	9.8	81735_Small Intestine	13.9
97501_Patient-12sk_skeletal muscle	7.0	72409_Kidney_Proximal Convoluted Tubule	2.0
97502_Patient-12ut_uterus	12.3	82685_Small intestine_Duodenum	2.1
97503_Patient-12pl_placenta	4.0	90650_Adrenal_Adrenocortical adenoma	<b>100.0</b>
94721_Donor 2 U - A_Mesenchymal Stem Cells	7.5	72410_Kidney_HRCE	12.7
94722_Donor 2 U - B_Mesenchymal Stem Cells	1.1	72411_Kidney_HRE	27.0
94723_Donor 2 U - C_Mesenchymal Stem Cells	4.2	73139_Uterus_Uterine smooth muscle cells	2.9

Table OH. Panel CNS\_1

Tissue Name	Rel. Exp.(%) Ag2031, Run 171620593	Rel. Exp.(%) Ag2839, Run 171669729	Tissue Name	Rel. Exp.(%) Ag2031, Run 171620593	Rel. Exp.(%) Ag2839, Run 171669729
BA4 Control	18.8	27.9	BA17 PSP	12.0	14.6
BA4 Control2	27.9	43.8	BA17 PSP2	4.3	5.1
BA4 Alzheimer's2	3.3	3.1	Sub Nigra Control	55.1	67.8
BA4 Parkinson's	36.1	40.1	Sub Nigra Control2	39.5	47.6
BA4 Parkinson's2	51.4	37.1	Sub Nigra Alzheimer's2	15.2	24.1
BA4 Huntington's	24.1	24.5	Sub Nigra Parkinson's2	57.8	79.0
BA4 Huntington's2	3.3	2.5	Sub Nigra Huntington's	86.5	<b>100.0</b>
BA4 PSP	5.0	5.4	Sub Nigra Huntington's2	36.6	38.7
BA4 PSP2	17.1	21.0	Sub Nigra PSP2	11.5	12.7
BA4 Depression	8.9	10.0	Sub Nigra Depression	5.9	9.3
BA4 Depression2	6.3	8.7	Sub Nigra Depression2	6.6	5.5



BA7 Control	26.6	28.7	Glob Palladus Control	20.7	15.2
BA7 Control2	25.5	31.9	Glob Palladus Control2	10.2	7.7
BA7 Alzheimer's2	4.8	4.7	Glob Palladus Alzheimer's	13.5	20.0
BA7 Parkinson's	13.7	17.6	Glob Palladus Alzheimer's2	4.7	5.5
BA7 Parkinson's2	20.7	20.6	Glob Palladus Parkinson's	<b>100.0</b>	82.9
BA7 Huntington's	24.0	34.2	Glob Palladus Parkinson's2	12.6	18.6
BA7 Huntington's2	31.2	31.9	Glob Palladus PSP	1.7	3.8
BA7 PSP	15.2	20.9	Glob Palladus PSP2	4.1	4.9
BA7 PSP2	13.0	18.4	Glob Palladus Depression	4.2	4.3
BA7 Depression	6.7	6.4	Temp Pole Control	8.4	9.6
BA9 Control	17.6	15.1	Temp Pole Control2	32.1	43.8
BA9 Control2	51.4	75.8	Temp Pole Alzheimer's	2.1	4.2
BA9 Alzheimer's	2.2	2.8	Temp Pole Alzheimer's2	2.7	4.6
BA9 Alzheimer's2	6.8	7.1	Temp Pole Parkinson's	20.9	22.5
BA9 Parkinson's	17.8	20.4	Temp Pole Parkinson's2	18.4	23.3
BA9 Parkinson's2	40.3	31.9	Temp Pole Huntington's	32.3	37.6
BA9 Huntington's	29.3	38.4	Temp Pole PSP	3.5	2.1
BA9 Huntington's2	8.3	8.0	Temp Pole PSP2	1.9	2.8
BA9 PSP	8.7	8.2	Temp Pole Depression2	4.2	5.4
BA9 PSP2	3.4	1.9	Cing Gyr Control	42.3	64.6
BA9 Depression	4.7	4.4	Cing Gyr Control2	26.8	27.0
BA9 Depression2	3.8	4.8	Cing Gyr Alzheimer's	13.0	20.0
BA17 Control	27.7	32.1	Cing Gyr Alzheimer's2	3.3	5.2

BA17 Control2	28.1	33.2	Cing Gyr Parkinson's	34.6	37.9
BA17 Alzheimer's2	2.8	3.1	Cing Gyr Parkinson's2	30.6	34.6
BA17 Parkinson's	27.2	30.1	Cing Gyr Huntington's	50.7	66.0
BA17 Parkinson's2	25.2	22.1	Cing Gyr Huntington's2	26.2	33.0
BA17 Huntington's	15.3	18.8	Cing Gyr PSP	12.2	17.4
BA17 Huntington's2	7.4	10.5	Cing Gyr PSP2	5.4	6.8
BA17 Depression	9.2	7.7	Cing Gyr Depression	5.4	8.6
BA17 Depression2	15.4	15.1	Cing Gyr Depression2	11.0	10.2

**CNS\_neurodegeneration\_v1.0 Summary:** Ag2839 While no association between the CG55910-01 gene and Alzheimer's disease is evident from the results of this panel, this experiment confirms expression of this gene in the brain. See Panel 1.3D for discussion of utility of this gene in the central nervous system.

- 5 **Panel 1.3D Summary:** Ag2031/2839 Brain-specific expression of the CG55910-01 gene suggests a role for this gene in CNS processes. Polyunsaturated fatty acids (PUFAs), specifically the n-3 and n-6 series, play a key role in the progression or prevention of human diseases such as obesity, diabetes, cancer, and neurological and heart disease. They function mainly by affecting cellular membrane lipid composition, metabolism, signal-transduction
- 10 pathways, and by direct control of gene expression. Therefore, modulators of this gene product may have utility in treating neurological diseases, such as Alzheimer's disease.

- This gene is also moderately expressed in a variety of metabolic tissues including pancreas, adrenal, thyroid, pituitary, adult and fetal heart, and adipose. This gene product appears to be differentially expressed in fetal (CT value = 30-32) vs adult skeletal muscle (CT
- 15 value = 34) and may be useful for the identification of the adult vs fetal source of this tissue. This gene encodes a fatty acid desaturase homolog. Fatty acid desaturases are on the metabolic pathway to triglyceride deposition. Thus, small molecule inhibition of this gene product may prevent the formation of fat and be effective in the treatment for obesity.

- Panel 2D Summary:** Ag2839 The expression of the CG55910-01 gene appears to be
- 20 highest in a sample derived from an ovarian cancer (CT=27.8). Of note is the difference in expression between this ovarian cancer and its normal adjacent tissue. There is also expression

in a number of ovarian cancer samples in this panel. Thus, the expression of this gene could be used to distinguish this ovarian cancer from its normal adjacent tissue. Moreover, therapeutic modulation of this gene, through the use of small molecule drugs, antibodies or protein therapeutics might be of benefit in the treatment of ovarian cancer.

5 **Panel 4D Summary:** Ag2031/2839 The CG55910-01 transcript is highly expressed in TNFalpha and Il-1beta stimulated small airway epithelium, normal thymus, dermal fibroblasts, and NCI-H292 cells but not in leukocytes. This expression pattern is consistent with both sets of primers and probes. The expression profile suggests that the protein encoded by this transcript could potentially regulate T cell development in the thymus and the response of  
10 small airway epithelium to proinflammatory cytokines. Thus, therapeutics designed with the protein encoded by this transcript could be important in immune modulation and in the treatment of lung diseases such as asthma and COPD.

**Panel 5D Summary:** Ag2839 Expression of the CG55910-01 gene is mainly restricted to adipose. This gene encodes an acetyl coA desaturase. Fatty acid desaturases are  
15 on the metabolic pathway to triglyceride deposition. Thus, small molecule inhibition of this gene product may prevent the formation of fat and be effective in the treatment for obesity. Thus, therapeutic modulation of the expression or function of this gene may be effective in the treatment of obesity.

**Panel CNS\_1 Summary:** Ag2839 While no association between the CG55910-01  
20 gene and any disease is evident from the results of this panel, this experiment confirms expression of this gene in the brain. See Panel 1.3D for discussion of utility of this gene in the central nervous system.

#### P. CG50281-01: 34 Wnt 10B like (NOV11)

Expression of gene CG50281-01 was assessed using the primer-probe set Ag2538,  
25 described in Table PA. Results of the RTQ-PCR runs are shown in Tables PB, PC, PD, PE and PF.

Table PA. Probe Name Ag2538

Primers	Sequences	Start Position	SEQ ID NO
Forward	5'-acaacgccttgactcttcttct-3'	115	332
Probe	TET-5'-aagacctccaagcctcagggactctg-3'-TAMRA	139	333
Reverse	5'-acaagaagaacaccccttgat-3'	168	334

Table PB. CNS\_neurodegeneration\_v1.0

Tissue Name	Rel. Exp.(%) Ag2538, Run 208779569	Tissue Name	Rel. Exp.(%) Ag2538, Run 208779569
AD 1 Hippo	19.6	Control (Path) 3 Temporal Ctx	5.2
AD 2 Hippo	35.4	Control (Path) 4 Temporal Ctx	24.7
AD 3 Hippo	1.6	AD 1 Occipital Ctx	6.8
AD 4 Hippo	0.0	AD 2 Occipital Ctx (Missing)	0.0
AD 5 Hippo	4.0	AD 3 Occipital Ctx	7.6
AD 6 Hippo	19.1	AD 4 Occipital Ctx	29.5
Control 2 Hippo	54.3	AD 5 Occipital Ctx	12.6
Control 4 Hippo	5.2	AD 6 Occipital Ctx	7.6
Control (Path) 3 Hippo	0.0	Control 1 Occipital Ctx	0.0
AD 1 Temporal Ctx	19.5	Control 2 Occipital Ctx	49.3
AD 2 Temporal Ctx	38.2	Control 3 Occipital Ctx	7.6
AD 3 Temporal Ctx	6.7	Control 4 Occipital Ctx	0.0
AD 4 Temporal Ctx	4.2	Control (Path) 1 Occipital Ctx	61.1
AD 5 Inf Temporal Ctx	43.5	Control (Path) 2 Occipital Ctx	2.6
AD 5 Sup Temporal Ctx	58.2	Control (Path) 3 Occipital Ctx	2.8
AD 6 Inf Temporal Ctx	58.2	Control (Path) 4 Occipital Ctx	28.3
AD 6 Sup Temporal Ctx	68.8	Control 1 Parietal Ctx	4.4
Control 1 Temporal Ctx	5.8	Control 2 Parietal Ctx	59.9
Control 2 Temporal Ctx	41.2	Control 3 Parietal Ctx	9.0
Control 3 Temporal Ctx	18.3	Control (Path) 1 Parietal Ctx	<b>100.0</b>
Control 3 Temporal Ctx	21.5	Control (Path) 2 Parietal Ctx	40.1
Control (Path) 1 Temporal Ctx	83.5	Control (Path) 3 Parietal Ctx	0.0
Control (Path) 2 Temporal Ctx	58.6	Control (Path) 4 Parietal Ctx	14.4

Table PC. Panel 1.3D

Tissue Name	Rel. Exp.(%) Ag2538, Run 162187100	Rel. Exp.(%) Ag2538, Run 165639905	Tissue Name	Rel. Exp.(%) Ag2538, Run 162187100	Rel. Exp.(%) Ag2538, Run 165639905
Liver adenocarcinoma	0.0	0.0	Kidney (fetal)	0.0	0.0
Pancreas	0.0	0.0	Renal ca. 786- 0	0.0	0.0
Pancreatic ca. CAPAN 2	0.0	0.0	Renal ca. A498	0.0	0.0
Adrenal gland	0.0	0.0	Renal ca. RXF 393	10.2	42.3
Thyroid	0.0	0.0	Renal ca. ACHN	0.0	0.0
Salivary gland	0.0	0.0	Renal ca. UO- 31	0.0	0.0
Pituitary gland	0.0	0.0	Renal ca. TK- 10	0.0	3.1
Brain (fetal)	18.0	46.7	Liver	0.0	0.0
Brain (whole)	11.3	0.0	Liver (fetal)	0.0	0.0
Brain (amygdala)	22.2	59.9	Liver ca. (hepatoblast) HepG2	0.0	0.0
Brain (cerebellum)	0.0	0.0	Lung	0.0	0.0
Brain (hippocampus)	31.6	66.9	Lung (fetal)	0.0	0.0
Brain (substantia nigra)	0.0	0.0	Lung ca. (small cell) LX-1	0.0	0.0
Brain (thalamus)	0.0	10.5	Lung ca. (small cell) NCI-H69	0.0	0.0
Cerebral Cortex	<b>100.0</b>	5.7	Lung ca. (s.cell var.) SHP-77	0.0	0.0
Spinal cord	0.0	0.0	Lung ca. (large cell) NCI-H460	0.0	58.6
glio/astro U87-MG	0.0	0.0	Lung ca. (non- sm. cell) A549	0.0	0.0
glio/astro U-118- MG	0.0	0.0	Lung ca. (non- s.cell) NCI- H23	8.7	0.0
astrocytoma SW1783	0.0	0.0	Lung ca. (non- s.cell) HOP-62	0.0	0.0
neuro*; met SK-N- AS	7.7	0.0	Lung ca. (non- s.cl) NCI- H522	0.0	0.0

astrocytoma SF-539	0.0	0.0	Lung ca. (squam.) SW 900	0.0	0.0
astrocytoma SNB-75	0.0	0.0	Lung ca. (squam.) NCI-H596	0.0	0.0
glioma SNB-19	6.8	0.0	Mammary gland	0.0	0.0
glioma U251	0.0	0.0	Breast ca.* (pl.ef) MCF-7	7.2	0.0
glioma SF-295	0.0	0.0	Breast ca.* (pl.ef) MDA-MB-231	0.0	0.0
Heart (fetal)	0.0	0.0	Breast ca.* (pl.ef) T47D	7.5	0.0
Heart	0.0	0.0	Breast ca. BT-549	0.0	15.6
Skeletal muscle (fetal)	4.5	0.0	Breast ca. MDA-N	0.0	0.0
Skeletal muscle	0.0	0.0	Ovary	0.0	0.0
Bone marrow	0.0	0.0	Ovarian ca. OVCAR-3	0.0	0.0
Thymus	0.0	0.0	Ovarian ca. OVCAR-4	0.0	0.0
Spleen	0.0	0.0	Ovarian ca. OVCAR-5	0.0	0.0
Lymph node	0.0	11.1	Ovarian ca. OVCAR-8	0.0	0.0
Colorectal	0.0	10.4	Ovarian ca. IGROV-1	0.0	0.0
Stomach	0.0	0.0	Ovarian ca.* (ascites) SK-OV-3	0.0	0.0
Small intestine	8.9	100.0	Uterus	0.0	0.0
Colon ca. SW480	0.0	0.0	Placenta	0.0	0.0
Colon ca.* SW620(SW480 met)	0.0	0.0	Prostate	0.0	0.0
Colon ca. HT29	0.0	0.0	Prostate ca.* (bone met)PC-3	0.0	0.0
Colon ca. HCT-116	18.4	0.0	Testis	38.4	0.0
Colon ca. CaCo-2	10.6	0.0	Melanoma Hs688(A).T	0.0	0.0
Colon ca.	0.0	0.0	Melanoma*	0.0	0.0

tissue(ODO3866)			(met) Hs688(B).T		
Colon ca. HCC-2998	14.5	0.0	Melanoma UACC-62	9.2	0.0
Gastric ca.* (liver met) NCI-N87	0.0	0.0	Melanoma M14	8.4	0.0
Bladder	23.3	15.0	Melanoma LOX IMVI	5.3	0.0
Trachea	0.0	0.0	Melanoma* (met) SK- MEL-5	0.0	51.4
Kidney	0.0	0.0	Adipose	0.0	0.0

Table PD. Panel 2D

Tissue Name	Rel. Exp.(%) Ag2538, Run 161920580	Tissue Name	Rel. Exp.(%) Ag2538, Run 161920580
Normal Colon	9.7	Kidney Margin 8120608	2.9
CC Well to Mod Diff (ODO3866)	0.0	Kidney Cancer 8120613	0.0
CC Margin (ODO3866)	9.8	Kidney Margin 8120614	0.0
CC Gr.2 rectosigmoid (ODO3868)	6.0	Kidney Cancer 9010320	0.0
CC Margin (ODO3868)	0.0	Kidney Margin 9010321	0.0
CC Mod Diff (ODO3920)	0.0	Normal Uterus	0.0
CC Margin (ODO3920)	0.0	Uterus Cancer 064011	0.0
CC Gr.2 ascend colon (ODO3921)	0.0	Normal Thyroid	0.0
CC Margin (ODO3921)	21.8	Thyroid Cancer 064010	0.0
CC from Partial Hepatectomy (ODO4309) Mets	0.0	Thyroid Cancer A302152	8.4
Liver Margin (ODO4309)	0.0	Thyroid Margin A302153	0.0
Colon mets to lung (OD04451-01)	0.0	Normal Breast	0.0
Lung Margin (OD04451- 02)	0.0	Breast Cancer (OD04566)	0.0
Normal Prostate 6546-1	0.0	Breast Cancer (OD04590-01)	8.0
Prostate Cancer (OD04410)	10.1	Breast Cancer Mets (OD04590-03)	0.0

Prostate Margin (OD04410)	0.0	Breast Cancer Metastasis (OD04655-05)	0.0
Prostate Cancer (OD04720-01)	0.0	Breast Cancer 064006	0.0
Prostate Margin (OD04720-02)	0.0	Breast Cancer 1024	0.0
Normal Lung 061010	10.4	Breast Cancer 9100266	0.0
Lung Met to Muscle (ODO4286)	0.0	Breast Margin 9100265	0.0
Muscle Margin (ODO4286)	0.0	Breast Cancer A209073	0.0
Lung Malignant Cancer (OD03126)	0.0	Breast Margin A2090734	8.5
Lung Margin (OD03126)	0.0	Normal Liver	0.0
Lung Cancer (OD04404)	0.0	Liver Cancer 064003	0.0
Lung Margin (OD04404)	0.0	Liver Cancer 1025	0.0
Lung Cancer (OD04565)	0.0	Liver Cancer 1026	0.0
Lung Margin (OD04565)	0.0	Liver Cancer 6004-T	0.0
Lung Cancer (OD04237-01)	0.0	Liver Tissue 6004-N	13.5
Lung Margin (OD04237-02)	0.0	Liver Cancer 6005-T	0.0
Ocular Mel Met to Liver (ODO4310)	0.0	Liver Tissue 6005-N	0.0
Liver Margin (ODO4310)	0.0	Normal Bladder	0.0
Melanoma Mets to Lung (OD04321)	0.0	Bladder Cancer 1023	0.0
Lung Margin (OD04321)	0.0	Bladder Cancer A302173	100.0
Normal Kidney	7.3	Bladder Cancer (OD04718-01)	46.3
Kidney Ca, Nuclear grade 2 (OD04338)	0.0	Bladder Normal Adjacent (OD04718-03)	0.0
Kidney Margin (OD04338)	8.4	Normal Ovary	0.0
Kidney Ca Nuclear grade 1/2 (OD04339)	8.3	Ovarian Cancer 064008	0.0
Kidney Margin (OD04339)	0.0	Ovarian Cancer (OD04768-07)	6.2
Kidney Ca, Clear cell type (OD04340)	0.0	Ovary Margin (OD04768-08)	0.0
Kidney Margin (OD04340)	0.0	Normal Stomach	0.0



Kidney Ca, Nuclear grade 3 (OD04348)	0.0	Gastric Cancer 9060358	0.0
Kidney Margin (OD04348)	0.0	Stomach Margin 9060359	0.0
Kidney Cancer (OD04622-01)	0.0	Gastric Cancer 9060395	0.0
Kidney Margin (OD04622-03)	0.0	Stomach Margin 9060394	6.7
Kidney Cancer (OD04450-01)	0.0	Gastric Cancer 9060397	0.0
Kidney Margin (OD04450-03)	0.0	Stomach Margin 9060396	0.0
Kidney Cancer 8120607	0.0	Gastric Cancer 064005	0.0

Table PE. Panel 3D

Tissue Name	Rel. Exp.(%) Ag2538, Run 164843785	Tissue Name	Rel. Exp.(%) Ag2538, Run 164843785
Daoy- Medulloblastoma	0.0	Ca Ski- Cervical epidermoid carcinoma (metastasis)	0.0
TE671- Medulloblastoma	0.0	ES-2- Ovarian clear cell carcinoma	0.0
D283 Med- Medulloblastoma	6.1	Ramos- Stimulated with PMA/ionomycin 6h	0.0
PFSK-1- Primitive Neuroectodermal	18.8	Ramos- Stimulated with PMA/ionomycin 14h	0.0
XF-498- CNS	0.0	MEG-01- Chronic myelogenous leukemia (megakaryoblast)	0.0
SNB-78- Glioma	0.0	Raji- Burkitt's lymphoma	0.0
SF-268- Glioblastoma	7.2	Daudi- Burkitt's lymphoma	0.0
T98G- Glioblastoma	0.0	U266- B-cell plasmacytoma	8.2
SK-N-SH- Neuroblastoma (metastasis)	0.0	CA46- Burkitt's lymphoma	0.0
SF-295- Glioblastoma	0.0	RL- non-Hodgkin's B-cell lymphoma	0.0
Cerebellum	0.0	JM1- pre-B-cell lymphoma	0.0
Cerebellum	0.0	Jurkat- T cell leukemia	0.0
NCI-H292- Mucoepidermoid lung carcinoma	0.0	TF-1- Erythroleukemia	0.0
DMS-114- Small cell lung cancer	3.7	HUT 78- T-cell lymphoma	0.0
DMS-79- Small cell lung	0.0	U937- Histiocytic lymphoma	0.0

cancer			
NCI-H146- Small cell lung cancer	0.0	KU-812- Myelogenous leukemia	0.0
NCI-H526- Small cell lung cancer	0.0	769-P- Clear cell renal carcinoma	0.0
NCI-N417- Small cell lung cancer	100.0	Caki-2- Clear cell renal carcinoma	0.0
NCI-H82- Small cell lung cancer	2.3	SW 839- Clear cell renal carcinoma	0.0
NCI-H157- Squamous cell lung cancer (metastasis)	0.0	G401- Wilms' tumor	0.0
NCI-H1155- Large cell lung cancer	0.0	Hs766T- Pancreatic carcinoma (LN metastasis)	0.0
NCI-H1299- Large cell lung cancer	0.0	CAPAN-1- Pancreatic adenocarcinoma (liver metastasis)	0.0
NCI-H727- Lung carcinoid	0.0	SU86.86- Pancreatic carcinoma (liver metastasis)	0.0
NCI-UMC-11- Lung carcinoid	0.0	BxPC-3- Pancreatic adenocarcinoma	0.0
LX-1- Small cell lung cancer	0.0	HPAC- Pancreatic adenocarcinoma	0.0
Colo-205- Colon cancer	0.0	MIA PaCa-2- Pancreatic carcinoma	0.0
KM12- Colon cancer	0.0	CFPAC-1- Pancreatic ductal adenocarcinoma	0.0
KM20L2- Colon cancer	0.0	PANC-1- Pancreatic epithelioid ductal carcinoma	0.0
NCI-H716- Colon cancer	0.0	T24- Bladder carcinma (transitional cell)	0.0
SW-48- Colon adenocarcinoma	0.0	5637- Bladder carcinoma	0.0
SW1116- Colon adenocarcinoma	7.2	HT-1197- Bladder carcinoma	0.0
LS 174T- Colon adenocarcinoma	0.0	UM-UC-3- Bladder carcinma (transitional cell)	0.0
SW-948- Colon adenocarcinoma	0.0	A204- Rhabdomyosarcoma	0.0
SW-480- Colon adenocarcinoma	0.0	HT-1080- Fibrosarcoma	0.0
NCI-SNU-5- Gastric carcinoma	0.0	MG-63- Osteosarcoma	0.0
KATO III- Gastric carcinoma	0.0	SK-LMS-1- Leiomyosarcoma (vulva)	0.0
NCI-SNU-16- Gastric	0.0	SJRH30- Rhabdomyosarcoma	0.0

carcinoma		(met to bone marrow)	
NCI-SNU-1- Gastric carcinoma	0.0	A431- Epidermoid carcinoma	0.0
RF-1- Gastric adenocarcinoma	0.0	WM266-4- Melanoma	5.0
RF-48- Gastric adenocarcinoma	0.0	DU 145- Prostate carcinoma (brain metastasis)	0.0
MKN-45- Gastric carcinoma	0.0	MDA-MB-468- Breast adenocarcinoma	0.0
NCI-N87- Gastric carcinoma	0.0	SCC-4- Squamous cell carcinoma of tongue	0.0
OVCAR-5- Ovarian carcinoma	0.0	SCC-9- Squamous cell carcinoma of tongue	0.0
RL95-2- Uterine carcinoma	0.0	SCC-15- Squamous cell carcinoma of tongue	0.0
HelaS3- Cervical adenocarcinoma	0.0	CAL 27- Squamous cell carcinoma of tongue	12.3

Table PF. Panel 4D

Tissue Name	Rel. Exp.(%) Ag2538, Run 164034950	Tissue Name	Rel. Exp.(%) Ag2538, Run 164034950
Secondary Th1 act	0.0	HUVEC IL-1beta	0.0
Secondary Th2 act	0.0	HUVEC IFN gamma	0.0
Secondary Tr1 act	6.0	HUVEC TNF alpha + IFN gamma	0.0
Secondary Th1 rest	0.0	HUVEC TNF alpha + IL4	0.0
Secondary Th2 rest	0.0	HUVEC IL-11	0.0
Secondary Tr1 rest	0.0	Lung Microvascular EC none	0.0
Primary Th1 act	0.0	Lung Microvascular EC TNFalpha + IL-1beta	0.0
Primary Th2 act	6.2	Microvascular Dermal EC none	0.0
Primary Tr1 act	6.7	Microvascular Dermal EC TNFalpha + IL-1beta	0.0
Primary Th1 rest	0.0	Bronchial epithelium TNFalpha + IL1beta	0.0
Primary Th2 rest	0.0	Small airway epithelium none	0.0
Primary Tr1 rest	4.2	Small airway epithelium TNFalpha + IL-1beta	0.0
CD45RA CD4 lymphocyte act	0.0	Coronary artery SMC rest	0.0
CD45RO CD4 lymphocyte act	0.0	Coronary artery SMC TNFalpha + IL-1beta	0.0

CD8 lymphocyte act	0.0	Astrocytes rest	0.0
Secondary CD8 lymphocyte rest	0.0	Astrocytes TNFalpha + IL-1beta	0.0
Secondary CD8 lymphocyte act	6.9	KU-812 (Basophil) rest	0.0
CD4 lymphocyte none	6.6	KU-812 (Basophil) PMA/ionomycin	0.0
2ry Th1/Th2/Tr1_anti-CD95 CH11	0.0	CCD1106 (Keratinocytes) none	0.0
LAK cells rest	3.5	CCD1106 (Keratinocytes) TNFalpha + IL-1beta	0.0
LAK cells IL-2	7.6	Liver cirrhosis	19.2
LAK cells IL-2+IL-12	0.0	Lupus kidney	0.0
LAK cells IL-2+IFN gamma	0.0	NCI-H292 none	0.0
LAK cells IL-2+ IL-18	0.0	NCI-H292 IL-4	0.0
LAK cells PMA/ionomycin	8.4	NCI-H292 IL-9	9.6
NK Cells IL-2 rest	3.1	NCI-H292 IL-13	7.1
Two Way MLR 3 day	8.5	NCI-H292 IFN gamma	0.0
Two Way MLR 5 day	0.0	HPAEC none	0.0
Two Way MLR 7 day	0.0	HPAEC TNF alpha + IL-1 beta	0.0
PBMC rest	0.0	Lung fibroblast none	0.0
PBMC PWM	0.0	Lung fibroblast TNF alpha + IL-1 beta	0.0
PBMC PHA-L	0.0	Lung fibroblast IL-4	0.0
Ramos (B cell) none	4.2	Lung fibroblast IL-9	0.0
Ramos (B cell) ionomycin	11.7	Lung fibroblast IL-13	0.0
B lymphocytes PWM	3.8	Lung fibroblast IFN gamma	0.0
B lymphocytes CD40L and IL-4	0.0	Dermal fibroblast CCD1070 rest	0.0
EOL-1 dbcAMP	11.5	Dermal fibroblast CCD1070 TNF alpha	10.6
EOL-1 dbcAMP PMA/ionomycin	60.3	Dermal fibroblast CCD1070 IL-1 beta	0.0
Dendritic cells none	0.0	Dermal fibroblast IFN gamma	0.0
Dendritic cells LPS	0.0	Dermal fibroblast IL-4	0.0
Dendritic cells anti-CD40	0.0	IBD Colitis 2	7.9
Monocytes rest	0.0	IBD Crohn's	7.1
Monocytes LPS	0.0	Colon	<b>100.0</b>

Macrophages rest	1.4	Lung	27.7
Macrophages LPS	4.7	Thymus	0.0
HUVEC none	0.0	Kidney	0.0
HUVEC starved	0.0		

**CNS\_neurodegeneration\_v1.0 Summary:** Ag2538 While no association between expression of the CG50281-01 gene and Alzheimer's disease is apparent in this panel, the profile here confirms expression of this gene in the brain. See Panel 1.3D for discussion of potential utility of this gene in the brain.

5           **Panel 1.3D Summary:** Ag2538 This gene encodes a Wnt 10b homolog, with low but significant expression in the brain in two experiments with the same probe and primer set. Wnt 10b is downstream of sonic hedgehog in follicular development. Sonic hedgehog regulates hair growth and when expressed in follicles can induce new hair growth. Therefore, expression of this gene by gene therapy may have therapeutic utility in the treatment of hair loss.

10           The wnt pathway has also been implicated in Alzheimer's disease. Agents that potentiate the signaling of this gene product may thus have utility in the treatment of neurodegenerative diseases such as Alzheimer's disease.

In addition, expression of this gene is extremely low in the cancer cell lines on this panel, suggesting that a decrease in expression correlates to cell proliferation.

15           **Panel 2D Summary:** Ag2538 The expression of the CG50281-01 gene is significantly increased in bladder cancer compared to normal bladder samples. These data indicate that the expression of this gene might be associated with bladder cancer and may be used as a diagnostic marker of disease. Thus, therapeutic modulation of the gene product by antibodies, small molecule inhibitors and chimeric molecules might be of use in the treatment of bladder cancer.

20           **Panel 3D Summary:** Ag2538 Expression of the CG50281-01 gene is limited to few cell lines on this panel including a lung cancer cell line and a cell line derived from squamous carcinoma of the tongue. Thus, expression of this gene could be used to differentiate these samples from other samples on this panel.

### 25   **Example 3. SNP analysis of NOVX clones**

**SeqCalling™ Technology:** cDNA was derived from various human samples representing multiple tissue types, normal and diseased states, physiological states, and developmental states from different donors. Samples were obtained as whole tissue, cell lines, primary cells or tissue cultured primary cells and cell lines. Cells and cell lines may have been

treated with biological or chemical agents that regulate gene expression for example, growth factors, chemokines, steroids. The cDNA thus derived was then sequenced using CuraGen's proprietary SeqCalling technology. Sequence traces were evaluated manually and edited for corrections if appropriate. cDNA sequences from all samples were assembled with themselves and with public ESTs using bioinformatics programs to generate CuraGen's human SeqCalling database of SeqCalling assemblies. Each assembly contains one or more overlapping cDNA sequences derived from one or more human samples. Fragments and ESTs were included as components for an assembly when the extent of identity with another component of the assembly was at least 95% over 50 bp. Each assembly can represent a gene and/or its variants such as splice forms and/or single nucleotide polymorphisms (SNPs) and their combinations.

Variant sequences are included in this application. A variant sequence can include a single nucleotide polymorphism (SNP). A SNP can, in some instances, be referred to as a "cSNP" to denote that the nucleotide sequence containing the SNP originates as a cDNA. A SNP can arise in several ways. For example, a SNP may be due to a substitution of one nucleotide for another at the polymorphic site. Such a substitution can be either a transition or a transversion. A SNP can also arise from a deletion of a nucleotide or an insertion of a nucleotide, relative to a reference allele. In this case, the polymorphic site is a site at which one allele bears a gap with respect to a particular nucleotide in another allele. SNPs occurring within genes may result in an alteration of the amino acid encoded by the gene at the position of the SNP. Intragenic SNPs may also be silent, however, in the case that a codon including a SNP encodes the same amino acid as a result of the redundancy of the genetic code. SNPs occurring outside the region of a gene, or in an intron within a gene, do not result in changes in any amino acid sequence of a protein but may result in altered regulation of the expression pattern for example, alteration in temporal expression, physiological response regulation, cell type expression regulation, intensity of expression, stability of transcribed message.

**Method of novel SNP Identification:** SNPs are identified by analyzing sequence assemblies using CuraGen's proprietary SNPTool algorithm. SNPTool identifies variation in assemblies with the following criteria: SNPs are not analyzed within 10 base pairs on both ends of an alignment; Window size (number of bases in a view) is 10; The allowed number of mismatches in a window is 2; Minimum SNP base quality (PHRED score) is 23; Minimum number of changes to score an SNP is 2/assembly position. SNPTool analyzes the assembly and displays SNP positions, associated individual variant sequences in the assembly, the depth of the assembly at that given position, the putative assembly allele frequency, and the SNP sequence variation. Sequence traces are then selected and brought into view for manual

validation. The consensus assembly sequence is imported into CuraTools along with variant sequence changes to identify potential amino acid changes resulting from the SNP sequence variation. Comprehensive SNP data analysis is then exported into the SNPCalling database.

**Method of novel SNP Confirmation:** SNPs are confirmed employing a validated method known as Pyrosequencing (Pyrosequencing, Westborough, MA). Detailed protocols for Pyrosequencing can be found in: Alderborn *et al.* Determination of Single Nucleotide Polymorphisms by Real-time Pyrophosphate DNA Sequencing. (2000). *Genome Research*. 10, Issue 8, August. 1249-1265. In brief, Pyrosequencing is a real time primer extension process of genotyping. This protocol takes double-stranded, biotinylated PCR products from genomic DNA samples and binds them to streptavidin beads. These beads are then denatured producing single stranded bound DNA. SNPs are characterized utilizing a technique based on an indirect bioluminometric assay of pyrophosphate (PPi) that is released from each dNTP upon DNA chain elongation. Following Klenow polymerase-mediated base incorporation, PPi is released and used as a substrate, together with adenosine 5'-phosphosulfate (APS), for ATP sulfurylase, which results in the formation of ATP. Subsequently, the ATP accomplishes the conversion of luciferin to its oxi-derivative by the action of luciferase. The ensuing light output becomes proportional to the number of added bases, up to about four bases. To allow processivity of the method dNTP excess is degraded by apyrase, which is also present in the starting reaction mixture, so that only dNTPs are added to the template during the sequencing. The process has been fully automated and adapted to a 96-well format, which allows rapid screening of large SNP panels. The DNA and protein sequences for the novel single nucleotide polymorphic variants are reported. Variants are reported individually but any combination of all or a select subset of variants are also included. In addition, the positions of the variant bases and the variant amino acid residues are underlined.

## Results

Variants are reported individually but any combination of all or a select subset of variants are also included as contemplated NOVX embodiments of the invention.

## NOV1

**Table 21. cSNP and Coding Variants for NOV1**

Variant	Base Position of cSNP	Wild Type	Variant	Amino Acid Change
13375592	221	A	G	Arg -> Gly at aa 72
13373919	299	G	C	Ala -> Pro at aa 98

13373884	301	T	C	silent
13373885	399	C	T	Ser -> Leu at aa 131
13375593	428	G	A	Gly -> Ser at aa 141
13375594	735	C	A	Thr -> Asn at aa 243
13375595	867	A	G	Asp -> Gly at aa 287

#### NOV4

Table 22. cSNP and Coding Variants for NOV4				
Variant	Base Position of cSNP	Wild Type	Variant	Amino Acid Change
13375361	809	G	A	Val → Ile at aa 258
13375360	1062	C	T	silent

5

#### NOV7

Table 23. cSNP and Coding Variants for NOV7				
Variant	Base Position of cSNP	Wild Type	Variant	Amino Acid Change
13375931	289	A	T	Ser → Cys at aa 87

#### NOV9

10

Table 24. cSNP and Coding Variants for NOV9				
Variant	Base Position of cSNP	Wild Type	Variant	Amino Acid Change
13376492	298	C	G	Asn -> Lys at aa 53
13376491	551	C	G	His -> Asp at aa 138

#### NOV11

Table 25. cSNP and Coding Variants for NOV9				
---	--	--	--	--



Variant	Base Position of cSNP	Wild Type	Variant	Amino Acid Change
13376495	864	G	A	Gly -> Asp at aa 204
13376494	1051	G	A	silent
13376493	1171	C	T	silent

## NOV12a

Table 26. cSNP and Coding Variants for NOV12a				
Variant	Base Position of cSNP	Wild Type	Variant	Amino Acid Change
13376475	156	C	T	silent
13376474	407	T	C	Ile -> Thr at aa 105
13376473	413	A	G	Asn -> Ser at aa 107
13376472	549	A	G	silent
13376471	841	G	A	Val -> Met at aa 250

5

## NOV12b

One or more consensus positions (Cons. Pos.) of the nucleotide sequence have been identified as SNPs. "Depth" represents the number of clones covering the region of the SNP. The Putative Allele Frequency (Putative Allele Freq.) is the fraction of all the clones containing the SNP.

10

Table 27. cSNP and Coding Variants for NOV12b				
Cons. Pos.	Depth	Wild Type	Variant	Putative Allele Freq.
964	46	T	C	0.065
973	46	T	A	0.065

## NOV13

Table 28. cSNP and Coding Variants for NOV13				
Variant	Base Position of cSNP	Wild Type	Variant	Amino Acid Change

13376476	461	T	C	silent
----------	-----	---	---	--------

## NOV15a

**Table 29. cSNP and Coding Variants for NOV15a**

Variant	Base Position of cSNP	Wild Type	Variant	Amino Acid Change
13376483	229	T	C	Ser -> Pro at aa 27
13376484	265	A	G	Lys -> Glu at aa 39
13376485	315	G	A	silent
13376486	376	A	G	Arg -> Gly at aa 76
13376487	465	C	T	silent
13374260	808	G	A	Ala -> Thr at aa 220
13374259	857	A	G	Gln -> Arg at aa 236
13374258	958	G	A	Gly -> Arg at aa 270

5

## NOV15d

One or more consensus positions (Cons. Pos.) of the nucleotide sequence have been identified as SNPs as shown in Table 2. "Depth" represents the number of clones covering the region of the SNP. The Putative Allele Frequency (Putative Allele Freq.) is the fraction of all the clones containing the SNP.

10

**Table 30. cSNP and Coding Variants for NOV15d**

Cons. Pos.	Depth	Wild Type	Variant	Putative Allele Freq.
494	50	G	A	0.040
512	49	G	T	0.184
569	70	A	G	0.043
679	113	G	A	0.018
682	113	G	A	0.018
687	114	G	A	0.026
731	114	A	G	0.018
736	114	A	G	0.035
751	113	C	T	0.018

759	114	T	C	0.026
763	114	A	G	0.018
792	132	A	C	0.030
794	132	A	T	0.015
800	132	A	G	0.015
840	169	G	A	0.012
847	169	A	G	0.024
856	171	T	C	0.064
861	171	C	T	0.023
1151	55	T	A	0.036
1152	55	T	C	0.036
1228	80	G	T	0.025
1234	81	C	T	0.025
1333	87	T	C	0.023
1431	91	G	A	0.022
1456	90	A	G	0.022
1493	89	A	G	0.022
1530	71	G	A	0.028
1727	120	A	G	0.025
1756	78	T	C	0.026
1845	67	T	C	0.030
1857	67	C	T	0.239
1885	59	G	A	0.034
7552	19	C	T	0.263

## NOV16

Table 31. cSNP and Coding Variants for NOV16				
Variant	Base Position of cSNP	Wild Type	Variant	Amino Acid Change
13375814	267	C	T	silent
13375816	488	A	G	Asn -> Ser at aa 153

13375815	690	C	A	silent
----------	-----	---	---	--------

## NOV19

Table 32. cSNP and Coding Variants for NOV19				
Variant	Base Position of cSNP	Wild Type	Variant	Amino Acid Change
13374210	237	G	A	Ser -> Asn at aa 36
13374212	3536	A	G	Thr -> Ala at aa 1136
13374213	3567	A	G	Gln -> Arg at aa 1146

5

## NOV20

One or more consensus positions (Cons. Pos.) of the nucleotide sequence have been identified as SNPs as shown in Table 2. "Depth" represents the number of clones covering the region of the SNP. The Putative Allele Frequency (Putative Allele Freq.) is the fraction of all the clones containing the SNP.

10

Table 33. cSNP and Coding Variants for NOV20				
Cons. Pos.	Depth	Wild Type	Variant	Putative Allele Freq.
212	8	G	A	0.250
311	12	A	G	0.250
523	9	A	G	0.222
554	8	A	G	0.250

## OTHER EMBODIMENTS

Although particular embodiments have been disclosed herein in detail, this has been done by way of example for purposes of illustration only, and is not intended to be limiting with respect to the scope of the appended claims, which follow. In particular, it is contemplated by the inventors that various substitutions, alterations, and modifications may be made to the invention without departing from the spirit and scope of the invention as defined by the claims. The choice of nucleic acid starting material, clone of interest, or library type is believed to be a matter of routine for a person of ordinary skill in the art with knowledge of the

15

embodiments described herein. Other aspects, advantages, and modifications considered to be within the scope of the following claims.